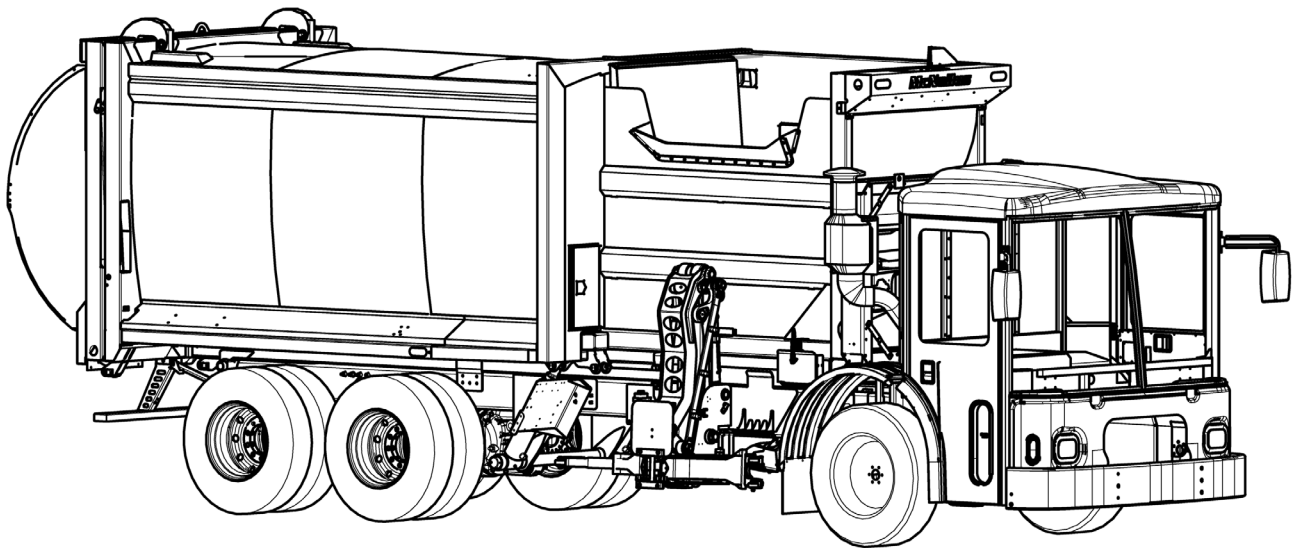


# AutoReach Service Manual

1474265



**Disclaimer:**

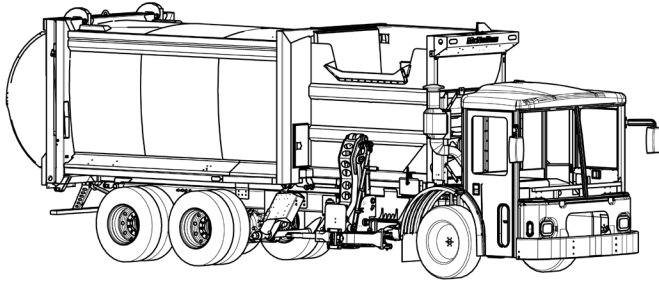
The information in this Service Manual will be your guide to servicing and preventive maintenance for this equipment.

All information, illustrations, and specifications in this manual are based on the information available at the time this manual was published. The illustrations used in this manual are intended as representative reference views only. Because of our continuous product improvement policy, we may modify information, illustrations, and/or specifications to explain and/or exemplify a product, service, or maintenance improvement. We reserve the right to make any change at any time without notice. Go to [www.streetsmartparts.com](http://www.streetsmartparts.com) for current information.

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For assistance in ordering the Waste  
Collection Vehicle Safety Guide, contact:  
National Waste and Recycling Association  
1550 Crystal Drive • Suite 804  
Arlington, VA 22202  
Telephone: 800-424-2869 • Fax: 202-966-4824

For assistance in ordering OSHA Publications, contact:  
U.S. Department of Labor/OSHA  
OSHA Publications  
P.O. Box 37535  
Washington, D.C. 20210  
Telephone: 202-693-1888 • Fax: 202-693-2498



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Section 1: General Information

Section 2: Safety

Section 3: Preventive Maintenance

Section 4: Troubleshooting

Section 5: Hydraulic Overspeed Control

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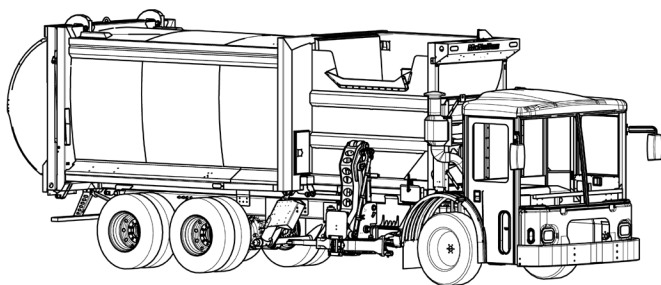
Section 7: Hydraulic

Section 8: Pneumatic

Section 9: Index

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## Thank You

Thank you for placing your confidence in our product. With proper maintenance, you will have a product that will serve your company for a number of years.

This manual is your guide for service and maintenance information. For parts information, manuals can be purchased through your McNeilus Parts and Service branch location. Please keep this manual in a safe place.

Protect your investment in McNeilus equipment. Do not jeopardize your warranty. Use only genuine McNeilus replacement parts. Original McNeilus Parts ensure the finest quality, the longest life and proper, reliable operation.

We encourage you to call anytime you have questions or require assistance with our product. We also welcome your suggestions and ideas. Always have your model and serial number ready when calling for information and parts.

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## 1.0 Identification Plate

A McNeilus Truck and Manufacturing, Inc. identification plate (Figure 1) is located on the left front side of the refuse vehicle body. The identification plate contains the Model Number and Serial Number of your refuse vehicle system.

To serve you better, please fill out the following information and have it ready when calling McNeilus Truck and Manufacturing, Inc. for parts or product information:

Date of Purchase: \_\_\_\_\_

McNeilus Branch: \_\_\_\_\_

Model Number of Refuse Vehicle: \_\_\_\_\_

Serial Number of Refuse Vehicle: \_\_\_\_\_

VIN\* \_\_\_\_\_

\*Refer to chassis manufacturer literature for location.

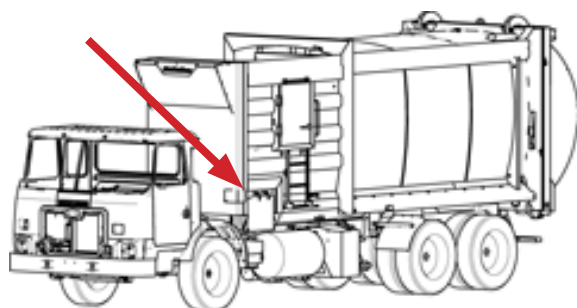


Figure 1

## 2.0 Complete Vehicle Document Decal

The complete vehicle document decal (Figure 2) documents the axle load and tire ratings as the vehicle left the McNeilus production line. This decal is located inside the cab and may be placed on the driver's door, doorjamb, or the seat riser.

This decal includes information such as the Gross Vehicle Weight (Figure 2, Item 1), Chassis manufacturer (Figure 2, Item 2), Chassis build date (Figure 2, Item 3), Vehicle (chassis) ID number (Figure 2, Item 4), Maximum rated weight per axle (Figure 2, Item 5), Tire and rim size (Figure 2, Item 6), Tire pressure specifications (Figure 2, Item 7), and the Packer system build date (Figure 2, Item 8).

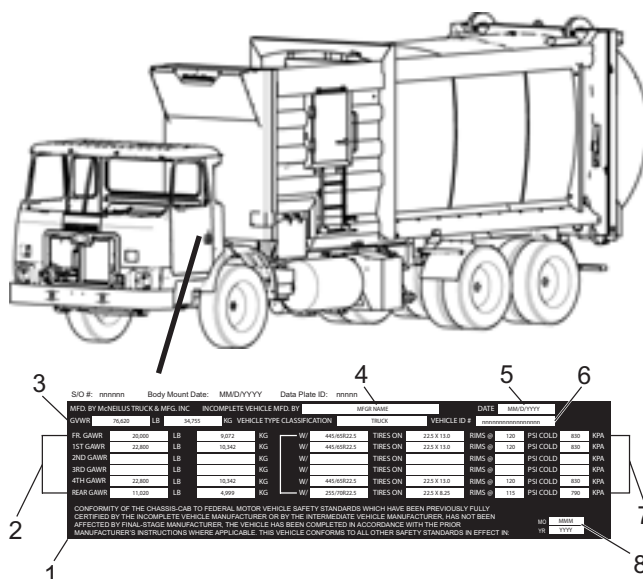


Figure 2

## 3.0 Parts and Service

Contact your McNeilus Parts and Service Branch Location to order parts, to receive service information, or for other assistance.

**Contact by phone or visit [www.streetsmartparts.com](http://www.streetsmartparts.com).**  
We have factory owned parts and service centers near you.

**Phone Number 888-686-7278**

State	City
CA	Colton
CT	East Granby
FL	Tampa
GA	Villa Rica
IL	Sugar Grove
IN	Fort Wayne
MN	Dodge Center
NY	Bronx
OH	Cincinnati
OH	Columbus
PA	Morgantown
TX	Houston
TX	Hutchins
UT	West Valley City
WI	Oshkosh

Canada	
Ontario and Western Provinces	800-265-1089
Quebec and Maritime Provinces	800-996-4937

## 4.0 Corporate Headquarters Information

Contact McNeilus Truck and Manufacturing, Inc. directly at our corporate headquarters at the following address, phone numbers, and website address:

McNeilus Truck and Manufacturing, Inc.  
524 County Road 34 East  
Dodge Center, MN 55927

Telephone: 507-374-6321

Corporate Website:  
[www.mcneiluscompanies.com](http://www.mcneiluscompanies.com)

Parts and Service Website:  
[www.streetsmartparts.com](http://www.streetsmartparts.com)

## 5.0 McNeilus Warranty Information

We want you to be satisfied with our product and our warranty. The McNeilus warranty manual outlines the warranty procedures. Please refer to it for answers to any questions you have regarding the policy or its procedures.

If you require a warranty manual, want to submit a warranty claim, have a dispute or any other comments regarding warranty, we request that you contact McNeilus Warranty Department at [warrantyclaims@mcneilusco.com](mailto:warrantyclaims@mcneilusco.com).

## 6.0 Purpose of This Manual

The purpose of this manual is to provide you with the most concise service and maintenance information for your McNeilus product.

## 7.0 How to Use This Manual

Within this manual you will find that the service and maintenance procedures are divided into major sections. The following explains the sections in this manual:

- **General Information** - This section provides general information about the vehicle
- **Safety** - This section provides safety information applicable for this vehicle
- **Preventive Maintenance** - This section provides maintenance schedules and information
- **Troubleshooting** - This section provides troubleshooting information and procedures
- **HOC** - This section provides Hydraulic Overspeed Control (HOC) information and testing procedures
- **Electrical** - This section provides electrical information and maintenance procedures
- **Hydraulics** - This section provides hydraulic information and maintenance procedures
- **Pneumatic** - This section provides pneumatic component information

### 8.0 General Vehicle Components

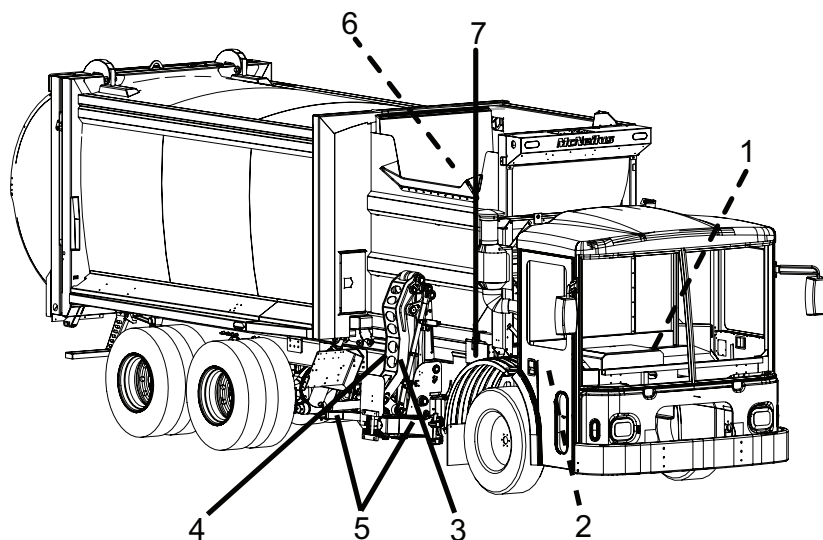


Figure 3

Ref. No	System Description
1	Cab Control Box and Joystick
2	Arm Remote Control Box
3	Primary Arm Assembly
4	Secondary Arm Assembly
5	Grabbers
6	Pack and Sweep
7	Clean Out Door

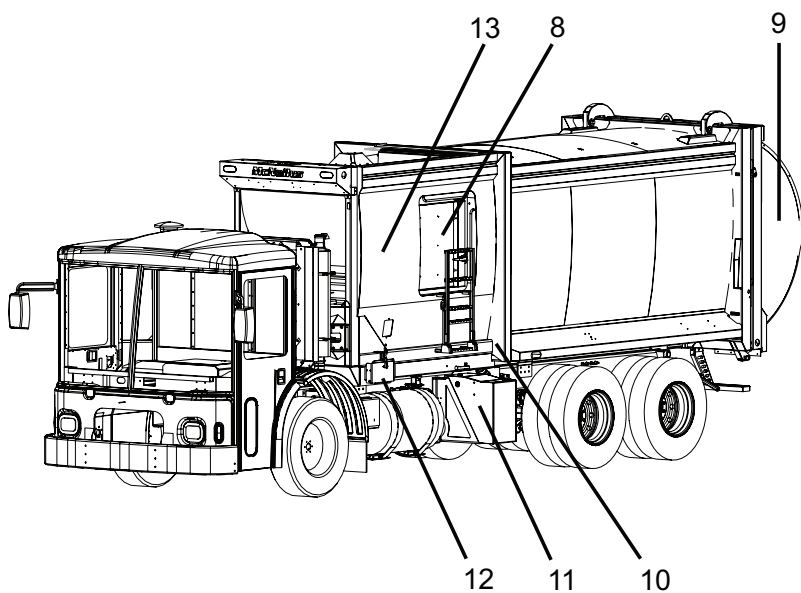


Figure 4

Ref. No	System Description
8	Side Access Door
9	Tailgate
10	Body Lift Cylinders
11	Hydraulic Oil Reservoir
12	Clean Out Door
13	Follower Plate

## 9.0 Abbreviations

The following is a list of abbreviations used in this manual and common abbreviations which may not be used in this manual.

Abbreviation	Definition
Accel	Acceleration
Act	Actuator
Adj	Adjustable
Adptr	Adaptor
AFE	Automated Full Eject
Amb	Amber
Amp	Amperes
Ang	Angle
ANSI	American National Standards Institute
Ant	Antenna
API	American Petroleum Institute
AR	Auto Reach, As Required
as req	As Required
Assy	Assembly
ATF	Automatic Transmission Fluid
Atl	Atlantic
Auto	Automated
Aux	Auxiliary
Ax	Axle
BH	Bulkhead
BHCS	Button Head Cap Screw
Bkt	Bucket
Blift	Body Lift
Blk	Black
Blk	Block
BLN	Bucket Loader Non-Compacting
BLP	Bucket Loader Packing
Blu	Blue
Bpr	Bumper
Brg	Bearing
Brkt	Bracket
Brl	Barrel
Brn	Brown
Brthr	Breather
Bsh	Bushing
Bt	Boot
Btm	Bottom
Bty	Battery

CAD-CAM	Computer Aided Design-Computer Aided Manufacture
Cam	Camera
Can	Container, Canister
Cart	Cartridge
CB	Combo Block
cc	cubic centimeter
Chl	Channel
Chr	Chrome
Circ	Circumference
Coal	Coalescing
Comp	Compensator
Conn	Connector
Cont	Container
Cot	Cotter
Cpscr	Cap Screw
CS	Curb Side
cSt	Centistokes
Ctr	Center
Ctrl	Control
Cvr	Cover
Cyl	Cylinder
CZ	Command Zone
Dblr	Doubler
Decel	Deceleration
Deg	Degree
Dia	Diameter
Diag	Diagonal
Diff	Diffuser
Dim	Dimension
Doc	Document
DOT	Department of Transportation
$\Delta P$	Change in pressure
DPDT	Double Pole Double Throw
Dr	Door
DS	Driver Side
Ejr	Ejector
Elb	Elbow
Elec	Electrical
Elem	Element
Hr	Hour
Hsg	Housing
Htr	Heater
Hvy	Heavy

Hyd	Hydraulic(s)
ICC	International Code Council
Ind	Indicator
INS	Inside
Intl	International
Inv	Inverted
ISO	International Standards Organization
JIC	Joint Industry Conference
JS	Joystick
lb. ft.	pounds per foot
Ldr	Ladder
LED	Light Emitting Diode
Lg	Long
LH	Left Hand
LN	Lock Nut
Lnr	Liner
Long	Longitudinal
Lo-Pro	Low Profile
LP	Low Profile
Lt	Light
Lvr	Lever
Lwr	Lower
MA	Manual Automated
Mag	Magnetic
Man	Manual
Metro	Metropolitan
MF	Male Female
MFD	Manifold
MFM	Male Female Male
Mid	Middle
Min	Minimum, Minute
MM	Male Male
MMF	Male Male Female
MMM	Male Male Male
Mod	Model, Modem
Mom	Momentary
Mont	Monitor
MPH	Miles Per Hour
MS	Midship
Mt	Mount
Mtg	Mounting
Mtl	Metal
Mtr	Motor

MV oils	Multiple Viscosity oils
NC	Normally Closed
NFPA	National Fluid Power Association
NO	Normally Open
NO Valve	Normally Open Valve
NPN	No Part Number
Npl	Nipple
NPT	National Pipe Thread
NSS	Not Serviced Separately
OEM	Original Equipment Manufacturer
Opt	Optional
ORB	O-Ring Boss
ORG	O-Ring Gasket
Orn	Orange
ORS	O-Ring Seal
OS	Outside
OSHA	Occupational Safety and Health Administration
Otr	Outer
P&S	Pack & Sweep, Parts & Service
Pac	Pacific
PB	Push Button
Pend	Pendant
PH	Pan Head
Pkr	Packer
Plt	Plate
Plw Blk	Pillow Block
Pneum	Pneumatic/s
Pnl	Panel
Press	Pressure
Prog	Program
Prox	Proximity
PS	Passenger Side
psi	pound per square inch
psi Δ	difference between two pressures
PTO	Power Take-off
Pvt	Pivot
Pwr	Power
QD	Quick Disconnect
Rad	Radius
Rbr	Rubber
Ref	Reference
Res	Reservoir, Residential
Ret	Return/Retract

# General Information



1

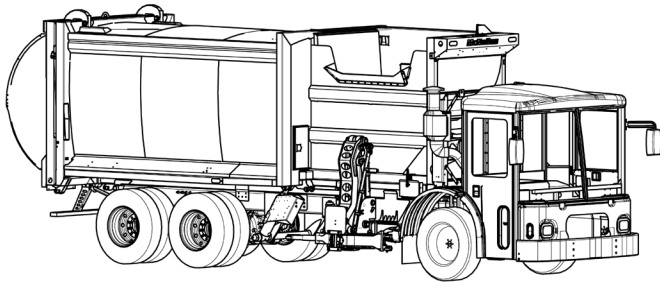
Rev	Revolution
Rf	Roof
Rfmt	Reinforcement
RGA	Returned Goods Authorization
Rgr	Regulator
RH	Right Hand
Rkr	Rocker
Rlf	Relief
Rmt	Remote
Rnd	Round
rpm	revolutions per minute
Rr	Rear
Rtg	Routing
Rtnr	Retainer
Rvt	Rivet
SAE	Society of Automotive Engineers
SB	Short Bubble
Scr	Screw
Scrn	Screen
SD	Side Door
Sec	Second
Sect	Section
Sens	Sensor
Serv	Service
SF	Street Force
SHCS	Socket Head Cap Screw
Shldr	Shoulder
Shrd	Shroud
Shrt	Short
Sht	Sheet
Shtr	Shutter
Skrt	Skirting
Sld	Slide
Slift	Service Lift
Sol	Solenoid
Spac	Spacer
SPDT	Single Pole Double Throw
Spec	Specification
Spl	Spherical
Sprg	Spring
SPST	Single Pole Single Throw
Spt	Support
SS	Street Side/Stainless Steel

SSU	Same as SUS
ST	Straight
STC	Snap To Connect
Std	Standard
Stl	Steel
Strnr	Strainer
SUS	Saybolt Universal Seconds
Sw	Switch
Swl	Swivel
Swp	Sweep
Sys	System
Tap	Tapping
TD	Top Door
Tel	Telescopic
Tele	Telescopic Cylinder
Temp	Temperature
Term	Terminal
Tg	Tailgate
Thrd	Thead/ed
Tk	Tank
TOB	Top of Body
Tog	Toggle
Torq	Torque
Tpr	Tipper
Tprd	Tapered
Trap	Trapezoid
U-Joint	Universal Joint
UNC	Unified Coarse
UNF	Unified Fine
Univ	Universal
Upr	Upper
Val	Valve
Vert	Vertical
VI	Viscosity Index
WB	Wheel Base
WG	Wind Guard
Wht	White
Wldt	Weldment
Wpr	Wiper
WPRV	Work Port Relief Valve
Wsr	Washer
Wtr	Water
X	Extended



XC	High Compaction
XL	Extra Large
Yel	Yellow
Z	Zinc

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**Safety**

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## 1.0 Important Safety Information

**READ AND UNDERSTAND THIS ENTIRE MANUAL BEFORE OPERATING, REPAIRING, OR ADJUSTING YOUR MCNEILUS EQUIPMENT.**

**THOSE WHO USE AND MAINTAIN THIS EQUIPMENT MUST BE THOROUGHLY TRAINED AND FAMILIAR WITH THE PRODUCT.**

**IF INCORRECTLY USED OR MAINTAINED, THIS EQUIPMENT CAN CAUSE SEVERE INJURY.**

Always keep this manual in a location where it is readily available for persons who operate or maintain the product. Additional copies of this manual are available from McNeilus Truck and Manufacturing, Inc. Please contact McNeilus Truck and Manufacturing, Inc. if you require additional manuals of if you have any questions about the information in this manual, this product, or safe operating procedures.

**THESE SAFETY PROCEDURES ARE FOR YOUR OWN PROTECTION.**

Do not operate this equipment until you have read its contents thoroughly. Read and understand the Waste Collection Vehicle Safety Guide that is placed in the vehicle's cab. Please contact McNeilus Truck and Manufacturing, Inc. if you require assistance.

Should operators of this equipment have a reading or learning disability, dyslexia, or other such condition, they must be assigned a mentor/trainer to read and explain to them the entire contents of this manual as well as the safety guidelines, danger, caution, and warning decals on this unit. Such individuals should not be allowed to operate this equipment until they thoroughly understand all of these materials. Failure to do so can result in serious injury or death.

Safety and safe working procedures must be followed at all times.

Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.146 and 1910.147 Confined Space as appropriate.

## 1.1 Battery Disconnect Switch

If the vehicle is equipped with a battery disconnect switch, it is located near the battery box. Use the battery disconnect switch when performing any maintenance so the vehicle cannot be accidentally started.

1. Turn the battery disconnect switch (Figure 3, Item 1) counterclockwise so the hole on the switch aligns with the hole in the bracket (Figure 3, Item 2).
2. Install the safety lockout device ring (Figure 4, Item 1) through the holes on the battery disconnect switch and the bracket.
3. Install a padlock (Figure 4, Item 2) onto the safety lockout device ring, lock it, and put the key in your pocket. If more than one person is working on the vehicle, each person must install his or her own padlock.

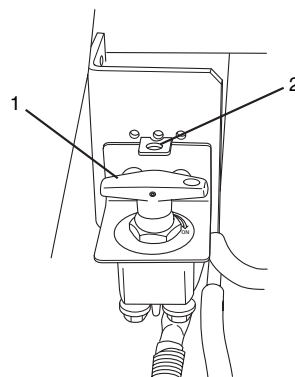


Figure 1

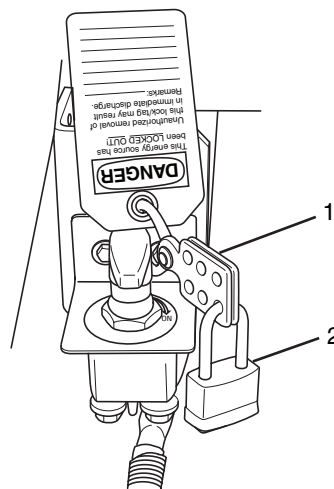


Figure 2

## 1.1.1 Battery Cable Disconnect

If the vehicle is not equipped with a battery disconnect switch, disconnect the negative (black) battery cable first, then disconnect the positive (red) cable.

**⚠ WARNING**

**For trucks without a battery disconnect switch, to prevent accidental vehicle start-up, which could cause death or serious injury, disconnect battery cables (negative cable first) before proceeding.**

**Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury.**

## 1.2 Safety Equipment

Some McNeilus Refuse Trucks come equipped with a five pound Fire Extinguisher, which has a rating of B:C, and a Reflective Warning Triangle Kit containing three triangles.

The fire extinguisher may already be mounted to the body, otherwise it is temporarily placed into the cab of your truck along with the reflective triangle kit.

If you are supplying your own fire extinguisher, it must comply with DOT FMCSA regulation 173.309 and 393.95 for rating and placement on the vehicle.

You are responsible for permanent mounting of this equipment. The fire extinguisher is required to be securely mounted to prevent sliding, rolling, or vertical movement. The placement and mounting location of the reflective triangles are at your discretion.

## 2.0 Safety Notices

Safety notices are one of the primary ways to call your attention to potential hazards.



Safety Alert Symbol

**THIS SAFETY SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL.**

**WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS.**

**BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.**

The following safety notices are used throughout this manual.

**⚠ DANGER**

**Danger indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Danger is used in the most extreme situations.**

**⚠ WARNING**

**Warning indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.**

**⚠ CAUTION**

**Caution indicates a situation that might result in property damage.**

**SAFETY NOTICE**

**OPERATOR'S INSTRUCTION**

The "signal words" of DANGER, WARNING, and CAUTION have specific meanings to alert you to the relative level of hazard.

Take the safety warnings seriously. If you do not understand them or have questions about them, call McNeilus Truck and Manufacturing, Inc.

## 3.0 Product Safety Information

Read, understand, and follow the safety guidelines and heed dangers and warnings listed below and contained in this manual as well as on the refuse vehicle itself to promote reliable operation and prevent serious personal injury.

Contact McNeilus Truck and Manufacturing, Inc. if you require assistance or have questions.

### 3.1 Safety Messages

#### WARNING

Safety decals must be replaced anytime they are damaged, missing, or cannot be read clearly. Failure to have proper decals in place can result in serious injury or death. If you require safety decals, please contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278.

#### WARNING

The Packer must not be modified in any way without authorization from McNeilus Truck and Manufacturing, Inc. Modifications may not comply with safety standards, including ANSI safety standards, and may result in serious personal injury. Please contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 if you require assistance.

#### WARNING

Wear Personal Protective Equipment (PPE) such as hard hats, safety glasses or goggles, sturdy gloves, hearing protection, steel toed boots, and snug fitting sturdy long-sleeve shirt and long pants when operating or maintaining the Packer. Reflective clothing is recommended for drivers and employees while packing during hours of darkness. Serious injury can result without proper PPE.

#### WARNING

Operating, servicing, and maintaining this vehicle or equipment can expose you to chemicals including exhaust, carbon monoxide, phthalates, and lead, which are known to the state of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle or equipment in a well ventilated area and wear gloves or wash hands frequently when servicing. For more information, go to [www.p65warnings.ca.gov](http://www.p65warnings.ca.gov).

#### Overhead Clearance for Electric Cables

Voltage of Electric Cables	Minimum amount of clearance from the electric cables when the unit is working	Minimum amount of clearance from electric cables when you drive the unit between jobs
50,000 volts or less	10 feet (3 m)	4 feet (1.2 m)
Over 50,000 volts	10 feet (3 m) plus 1/2 inch (10 mm) for every 1,000 volts over 50,000 volts	10 feet (3 m)
345,000 - 750,000 volts		16 feet (5 m)

**NOTE:** If local rules and laws require more clearances, you must follow them.

### 3.2 Cab Operation

#### WARNING

Operators must comply with Employee Responsibilities as outlined in ANSI Z245 and state, federal, and other safety and transportation regulations (e.g. OSHA, DOT, Motor Carrier, and FMVSS) when operating this refuse vehicle. Failure to comply may result in serious personal injury or death.

## DANGER

If the Packer comes into contact or close proximity with a power line or there is any arcing, stay in the truck cab and keep away from the metal parts of the unit. Do not let anyone come close to the truck. Do not attempt to jump clear of the truck. Stay in the cab. The power company must disconnect the power before you can safely leave the cab.

Minimum clearance from power lines:

50,000 Volts or Less	4 Feet
50,000 + Volts	10 Feet
345,000 - 750,000 Volts	16 Feet

Know the clearance of overhead obstructions. Never drive the Packer under any overhead obstruction. Failure to do so may result in damage to the Packer body or truck, and may result in serious personal injury or death.

## DANGER

If chassis is equipped with a stand-up drive position, use stand-up position only during refuse pick-up or collection activities for distances of less than 2/10 mile (0.32 km). Failure to heed this warning may result in serious personal injury or death.

## DANGER

DO NOT operate vehicle in excess of 20 MPH from stand-up position. Failure to do so can result in serious personal injury or death.

## WARNING

No passenger is allowed in the cab unless a manufacturer's approved passenger seat and seat belt are provided. Serious injury or death can result.

## DANGER

Always drive defensively. Never exceed posted speeds. Use lower speeds when going around curves, corners, or freeway on/off ramps. You are carrying a high center of gravity load. Failure to comply can lead to a roll over or other loss of control of the vehicle resulting in serious personal injury or death.

## WARNING

Be sure all non-operator personnel are at least 20 feet (6 meters) away from all areas of the Packer.  
Serious personal injury or death may occur.

## DANGER

Make sure the area above the vehicle is clear of objects and power lines before raising the arm.  
Serious personal injury or death may occur.

## WARNING

All owners and supervisors should make sure all drivers, operators, and maintenance personnel have read and thoroughly understand the decals affixed to this Packer as well as the safety information and instructions in the McNeilus Operator Manual. Owners and supervisors must comply with ANSI Z245.1 Regulations.

## WARNING

If equipped with optional camera or object detection system, do not rely exclusively on the camera or object detection system. Follow all other safe driving procedures. Failure to heed this warning may result in serious personal injury or death.

## WARNING

At the landfill or when operating off-road, use the lowest transmission gear and proceed at low speed (3 mph maximum). Failure to comply can cause serious injury.

## ⚠ WARNING

It is important that the pump ON indicator light is working. No damage will be done to the hydraulic system if the Packer is driven with the pump in the ON position. However, the controls will function if accidentally bumped. This can cause serious injury or death.

## ⚠ CAUTION

Always check indicator lights in the chassis cab or on the control panel at the front of the Packer. Replace bulbs or lights when required. (Note: All models may not have indicator lights.) Failure to inspect indicator lights may lead to more serious conditions.

## ⚠ CAUTION

If you detect a problem with any control function, it must be repaired immediately. **DO NOT** operate the Packer with malfunctioning controls. Damage to property or equipment may occur.

### 3.3 Outside Operation

## ⚠ DANGER

Never attempt to clear a jammed Packer or container lift, enter a body or open an access door unless power is shut down, LOCKOUT/TAGOUT procedures have been complied with, and the employee is authorized, trained, and competent to perform such activities. Failure to comply may result in serious personal injury or death.

## ⚠ WARNING

Keep access door closed when in operation. Do not open access door unless:

1. Engine is stopped.
2. Key is removed from ignition
3. Hydraulic pressures are relieved.
4. OSHA LOCKOUT/TAGOUT Regulations are complied with.

Failure to heed these instructions/warnings may result in serious personal injury or death.

## ⚠ WARNING

Never walk or stand behind vehicle while it is backing up. Failure to heed these instructions/warnings may result in serious personal injury or death.

## ⚠ WARNING

Never climb on windshield guard (if equipped). This is not a ladder. If equipped, use the ladder provided on the body to access the top of the vehicle. Failure to comply may result in serious personal injury or death.

## ⚠ CAUTION

If chassis is equipped with a battery disconnect switch, it must be turned off anytime the equipment is parked overnight, in a shop, or out of service for any extended period of time. Failure to do so may result in a fire and personal injury or property damage.

## ⚠ CAUTION

Be sure to drain the water tank, hoses, and pipes when operating in temperatures below freezing. Failure to drain the system may cause damage to equipment.

## ⚠ WARNING

Do not drink the water. Serious internal injury may result.



## WARNING

### IMPORTANT ALUMINUM AND STEEL WATER TANK INFORMATION.

1. Inspect water tank on a daily basis for any damage including, but not limited to, dents, gouges in metal, or leaks.
2. Do not weld on or repair water tank. Instead, replace water tank with a new OEM water tank.
3. Never pressure test an empty water tank. Only pressure test a full water tank.
4. Never remove pressure regulator or pressure safety valve from tank.
  - If regulator or safety valve is defective, it must be replaced before vehicle is put into service.
5. Do not pressurize water tank beyond its working pressure.
  - If pressure exceeds the working pressure, immediately depressurize water tank and replace pressure regulator and pressure safety valve.
6. Never drive the vehicle with the water tank pressurized.
  - Depressurize water tank prior to transit to or from job site.
  - Water tank should be pressurized only when being used.
7. Never modify water tank in any way.
8. Immediately replace safety decals with McNeilus decals if decals are missing or difficult to read.
9. Refer to the McNeilus Operator's Manual or contact McNeilus at 1-888-686-7278 if you have questions or require assistance.

## WARNING

Be sure all non-operator personnel are clear of the area around the Packer before operating the Packer. Remain attentive at all times when operating the controls. Watch the mirrors for activity. Never back up the Packer unless and until you are completely sure it is safe. Use a spotter/observer and/or get out and check yourself, if necessary, to ensure it is safe to do so. Thoroughly understand the controls before operating the Packer. Failure to heed this warning may result in serious personal injury or death.

## WARNING

Before opening the tailgate, be sure you have adequate clearance above the tailgate to prevent contact with buildings, electrical lines, and any other overhead obstructions. Failure to comply can cause damage to the vehicle and serious personal injury.

## WARNING

Always keep hands and feet and other parts of your body clear of revolving or moving parts. Failure to comply can cause serious injury.

## WARNING

The Packer and chassis should never be overloaded. Do not exceed the manufacturer's recommended gross vehicle weight. Do not overload the Packer and chassis. Gross weights must meet federal, state, and local laws. Failure to comply can cause serious injury.

## WARNING

Do not leave the truck unattended until the parking brake has been securely set and all reasonable precautions have been taken to prevent the movement of the truck. The operator must chock the truck wheels anytime he is away from the vehicle for an extended period of time. Wheel chocks are available for purchase from McNeilus Truck and Manufacturing, Inc. by calling 888-686-7278.

Failure to comply may result in serious personal injury or death or damage to equipment.

## 3.4 Maintenance

### SAFETY NOTICE

Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

## DANGER

LOCKOUT/TAGOUT procedures must be followed when working on this equipment including, but not limited to, cylinders being changed or maintained. Failure to heed these instructions/warnings can result in serious personal injury or death.

## DANGER

If the hydraulic or electrical system on the Packer fails to operate for any reason, call a competent technician to repair the problem. Never let any untrained or incompetent personnel attempt to fix any problems or malfunctions that may occur. If you are not trained or do not have the competence, never attempt to fix any problems or malfunctions that may occur. Never alter the original equipment manufacturer's design.

## DANGER

Auxiliary pusher or tag axles must be supported with jack stands, blocks, or similar devices while being serviced or maintained to prevent serious personal injury or death if auxiliary axle drops unexpectedly. Failure to do so may result in serious personal injury or death.

## DANGER

Use the three-point rule when climbing the ladder. Failure to heed may cause serious personal injury.

## DANGER

Never attempt to use extraneous sources of power or extraneous machines to overcome a malfunctioning system. Never override with overhead cranes, forklifts, jacks, etc. or alter or modify systems or equipment that may be malfunctioning. Failure to heed these instructions/warnings can result in serious personal injury or death.

## DANGER

PACKER BODY MUST BE EMPTY and body props employed when servicing Packer body in the raised position. Body props are meant to support only the empty body. Never overload.

Failure to empty body or employ body props may cause serious personal injury or death.

## DANGER

Verify that the body props are fully seated in the pockets on the frame.

Serious personal injury or death may occur.

## DANGER

Crush hazard. Verify that the body props are properly positioned around the rods of the cylinders.

Serious personal injury or death may occur.

## DANGER

Stand clear when the tailgate is in motion and during the unloading cycle. Do not stand under or cross under the raised tailgate.

Serious personal injury or death may occur.

## DANGER

Whenever the tailgate is in a raised position, it must be securely propped or blocked so it cannot fall on anyone.

Serious personal injury or death may occur.

## WARNING

Anytime a tailgate is raised in the shop or for maintenance, the tailgate must be supported to prevent the tailgate from coming down unexpectedly. Never allow anyone to work around or enter the tailgate area unless the tailgate is raised and supported! Failure to follow this procedure can result in serious injury or death.

## WARNING

Never place yourself between the tailgate and the body. Always engage both tailgate props when performing maintenance or inspections in or around the open tailgate area.

Failure to engage both tailgate props may result in serious personal injury or death.

## WARNING

Daily inspections should be performed on the Packer. This includes proper operation of the controls, hydraulic systems, electrical systems, optional cameras are clean and working, camera lens is clean, lighting system including turn signals, back up alarm, brake lights, clearance lights, head lamps, tail lamps, safety equipment, and work lights are all operational. The Packer's air system must operate properly and have no leaks. Water and moisture should be drained from the Packer's air system daily. Failure to ensure all systems are operating properly can result in serious personal injury or death.

## WARNING

Do not wear watches, rings, and jewelry while working with electrical and mechanical equipment. These items can be hazardous and can cause serious and painful injuries if they come into contact with electrical wires, moving parts, or hydraulic equipment.

## WARNING

Use only the access door for entry to the Packer. Remember to follow the LOCKOUT/TAGOUT procedures when entering the Packer body. Only exit the Packer body through the access door.

## WARNING

If equipped with optional camera, camera lens must be kept clean at all times to help achieve good monitor pictures. Failure to heed this warning may result in serious personal injury or death.

## CAUTION

Correct all identified deficiencies BEFORE operating the Packer. Failure to correct deficiencies may cause damage to equipment.

## WARNING

Electrical wiring, battery wiring, and electrical cable must be inspected on a daily basis for cuts, abrasions, damage, aging, improper clearance and along the frame for hidden damage. If you find electrical wiring or electrical cable with any such adverse conditions or damage, they must be replaced with electrical wiring or electrical cable of equivalent specifications before the Packer is returned to service. Failure to properly inspect and maintain your Packer may result in serious personal injury or death.

## WARNING

When working on the Packer, the wheels must be blocked, the parking brake on, LOCKOUT/TAGOUT procedures in effect, and the keys out of the truck's ignition. Failure to do so may result in serious personal injury or death.

## WARNING

Do not repair or weld steel or aluminum water tanks. Inspect the water tank for rust or corrosion every 30 days. Inspect the water tank under the straps, on the exterior, and on the interior by removing the flopper. If any rust or corrosion is found, replace the water tank with an OEM water tank from McNeilus. Failure to maintain water tanks may result in serious personal injury or death.

## ⚠ WARNING

Packer must be disabled by the following steps before proceeding.

1. Place transmission in NEUTRAL.
2. Apply chassis parking brake.
3. Shut engine OFF.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis BATTERY switch OFF.

Failure to disable the Packer may result in serious personal injury or death.

## ⚠ CAUTION

Disconnect battery before welding on body. Failure to do so might result in personal injury or damage to property or equipment.

## ⚠ CAUTION

Never attempt to prop a body or tailgate unless completely empty.  
Never walk or work under a raised body or tailgate unless props are in place.  
Failure to do so may result in serious personal injury or equipment damage.

## 3.5 Hydraulics

Call McNeilus Truck and Manufacturing, Inc. at 888-686-7278 anytime you have questions concerning hydraulic hoses, tubes, or pipes.

## ⚠ DANGER

Hydraulic systems operate under very high pressure. Hydraulic fluid escaping from a pressurized system can penetrate unprotected body tissue. Never inspect for hydraulic leaks with bare hands or other exposed body parts. As a minimum, wear leather gloves and use cardboard or wood to inspect for leaks. If leaks are present, relieve pressure and allow system to cool prior to servicing. If injured by escaping hydraulic oil, contact a physician immediately. Serious complications may arise if not treated immediately.

## ⚠ WARNING

Hydraulic hoses and tubing must be inspected on a daily basis for leaks, cuts, abrasions, damage, aging, improper clearance, and along the frame for hidden damage. If you find hoses with any such adverse conditions or damage, they must be replaced before the vehicle is returned to service! Failure to properly inspect and maintain your vehicle may result in serious personal injury or death.

## ⚠ WARNING

Hydraulic systems are hot. **DO NOT TOUCH!** Serious personal injury or death may result from hot oil. When you have completed working on the hydraulic systems, thoroughly clean any spilled oil from the equipment. Do not spill any hydraulic fluid on the ground. Clean any hydraulic fluid from your skin as soon as you have completed your maintenance and repairs. Dispose of used oil and filters as required by law.

## ⚠ WARNING

The hydraulic cylinders can be holding a function in a certain position when the engine is OFF. An example of this would be a function being held in the lift or partial lift position by the cylinders. If a hydraulic line is removed or the hydraulic circuits or controls are being worked on, gravity may allow the function being held in position to drop. All workers and personnel must remain clear of these areas when working on or operating the McNeilus equipment. Block and secure all applicable devices and functions before beginning work or operation. Failure to comply with this can result in serious injury or death.

## ⚠ WARNING

Hydraulic hoses have the SAE ratings marked on the hose to assist in selecting the correct hose. Replacement hydraulic hose and fitting components must be supplied by the same manufacturer to prevent serious injury or death. An example: Brand "A" hose and brand "B" fitting will not normally be compatible.

## WARNING

Hydraulic systems operate under high pressure. Only qualified, experienced people properly trained in hydraulic system maintenance should attempt repairs or troubleshoot hydraulic systems. Use the proper tools and equipment when servicing the hydraulic system. Failure to comply can cause serious injury. Please contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 if you require assistance.

## WARNING

Increasing hydraulic pressure beyond the recommendations may result in serious damage to the Packer or serious personal injury or death and may void the Packer Warranty.

## WARNING

All hydraulic pressures must be relieved from the hydraulic system prior to removing any components from the system to prevent oil from spraying or functions or systems from falling. Failure to follow this procedure can result in serious personal injury or death.

## WARNING

Do not steam clean or pressure wash the pump or hydraulic hose. Cleaning the pump with a high pressure washer or steam cleaning may damage the pump's seals and allow water to enter the hydraulic system. Cleaning the hydraulic hose with a high pressure washer or steam cleaning will damage the hose's outer covering and steel braid and lead to premature failure. The pump and hydraulic hose should be wiped with a clean lint-free cloth rather than washed.

## WARNING

Hydraulic components can be heavy. Use caution while lifting these components. Serious personal injury can be avoided with proper handling of the components.

## WARNING

Do not heat hydraulic tubing. The carbon content of this steel tube is such that if heated for bending, and either water or air is quenched, the tubing may lose its ductility and thereby be subject to failure under high pressure or hydraulic shock conditions. Serious injury can result. Damaged or leaking tubing must be replaced before the Packer is returned to service. Please contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 if you require assistance or have questions.

## 3.6 Electrical

## WARNING

Proximity switches must remain functional for safe operation of the Packer. If a switch does not work, it must be replaced immediately with an OEM switch before the Packer returns to service. Failure to comply can result in serious injury or death. Contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 for assistance if required.

## WARNING

If a prox switch does not work, it should be replaced with an OEM switch. Non-OEM switches may not be correct and may result in an accident.

Failure to follow regulations may cause serious personal injury or death.



## 4.0 Safety Signs

The following safety signs are found on your refuse collection system and warn of hazards related to the use of this equipment. Read and understand all safety signs before operating this equipment.

### NOTE

Depending on the Packer configuration and optional equipment, the actual location of decals and/or placards may vary slightly from the examples shown.

If any safety signs on the equipment are not clearly readable, call McNeilus Parts and Service at 888-686-7278 or visit [www.streetsmartparts.com](http://www.streetsmartparts.com) to order replacements. Use only McNeilus replacement decals.

The table below contains part numbers for the individual safety signs. See the Figures in this section for safety sign locations and the remaining pages of this section for sign identification.

### NOTE

Specifications, appearance, and part numbers for safety decals are subject to change without notice.

No.	Part Number	Qty.	Comments
1	0614383	2	
2	0614411	1	
3	0614379	1	
4	0614299	3	
5	0614582	1	
6	0614375	2	
7	1108358	2	
8	0614577	2	
9	0614530	2	
10	1319709	1	
11	0614376	1	
12	0614578	1	
13	0614448	3	
14	0214500	1	
15	0614378	4	
16	0614296	1	
17	0614286	1	
18	0614541	1	
19	0614542	2	
20	0614548	1	
21	1319707	2	
22	0614305	1	

No.	Part Number	Qty.	Comments
23	1140908	1	
24	1109764	1	
25	0614261	1	
26	1108425	1	
27	1107479	1	
28	0614560	1	
29	0614559	1	
30	1319703	2	
31	1108423	2	
32	0214618	1	
33	See Parts Manual	1	
34	1225787	2	
35	0614547	2	
36	1133532	1	
37	1459728	1	
38	1180686	1	
39	0614583	1	
40	0614446	2	
41	0638267	1	
42	Patent Pending	3	
43	1265704	Varies	2" White Conspicuity Tape
44	1260913	Varies	1" Red/White Conspicuity Tape - Bumper Only
45	1260914	Varies	2" Red/White Conspicuity Tape - Body and Tailgate

## 4.1 Safety Sign Location

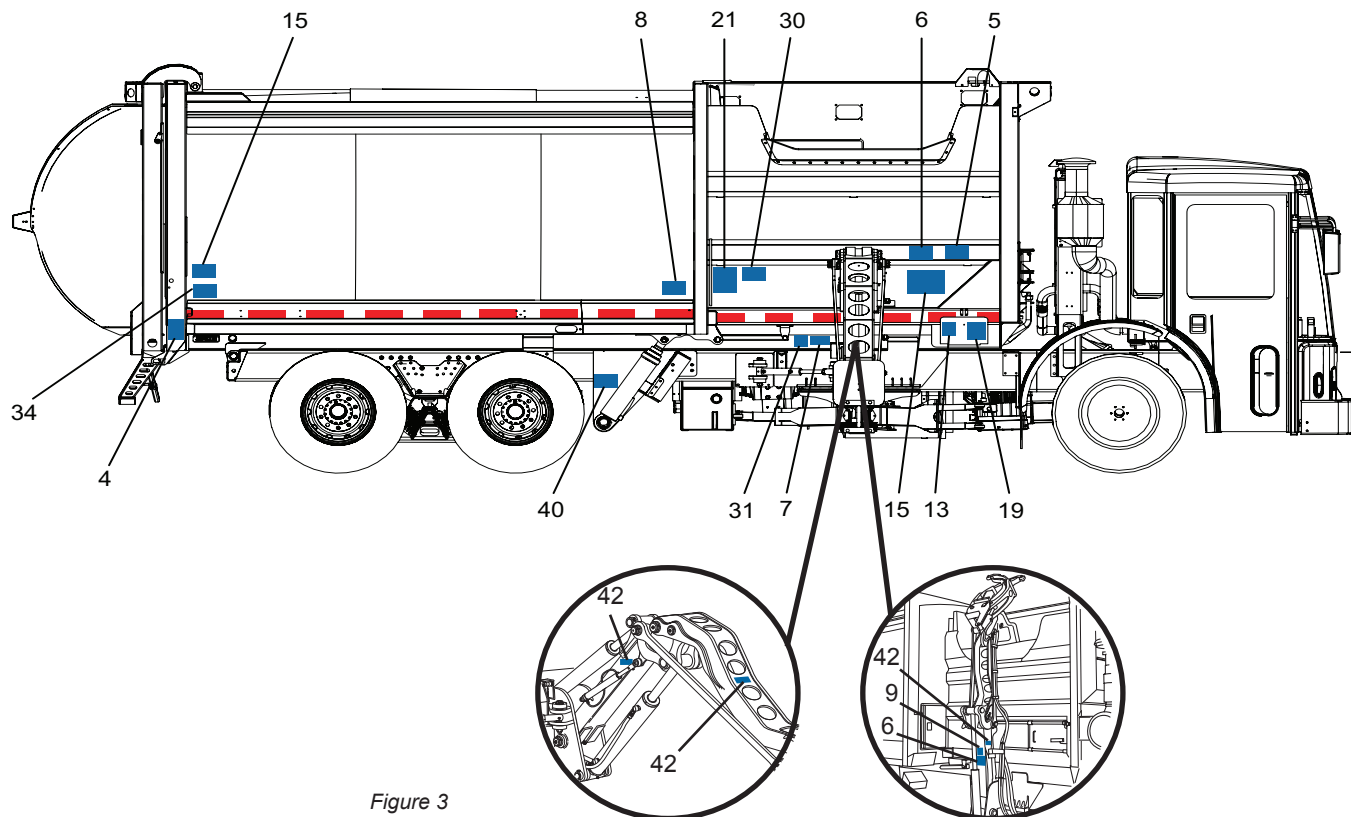


Figure 3

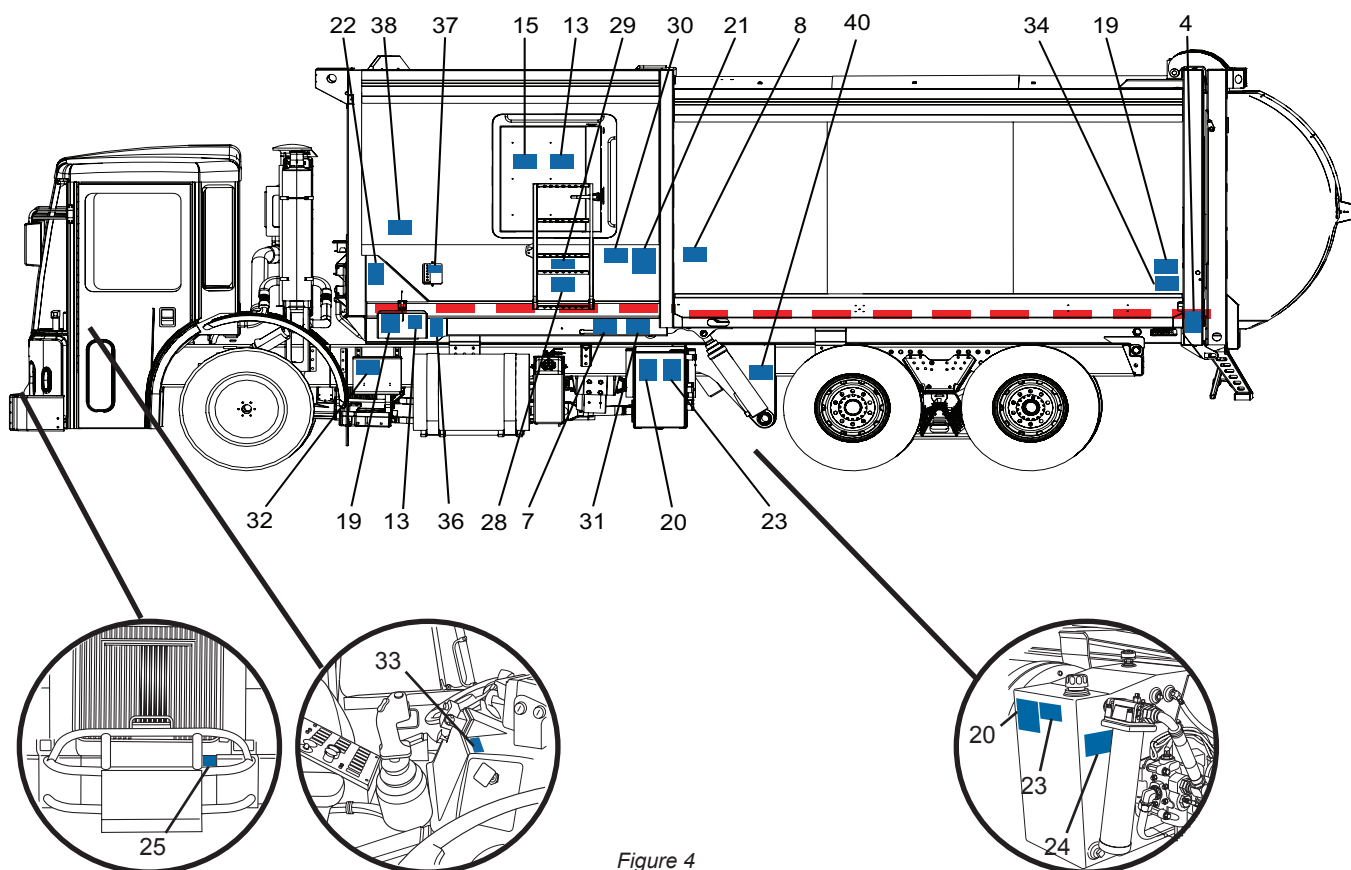
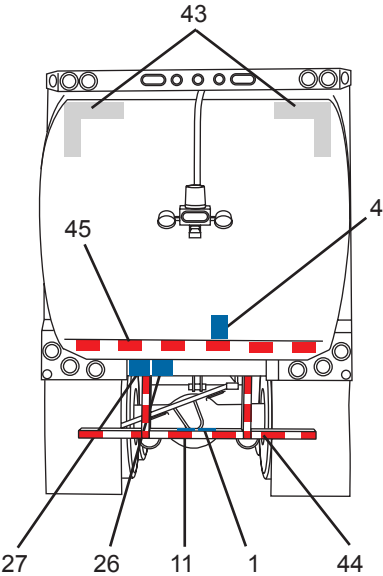
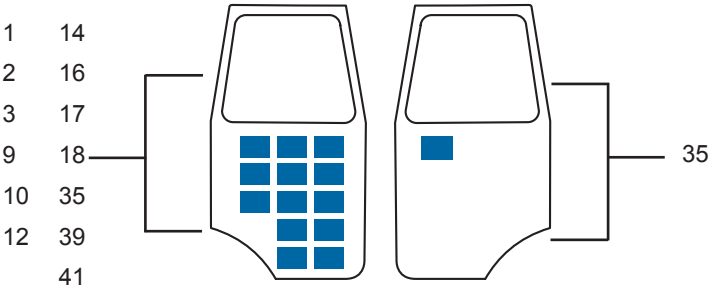
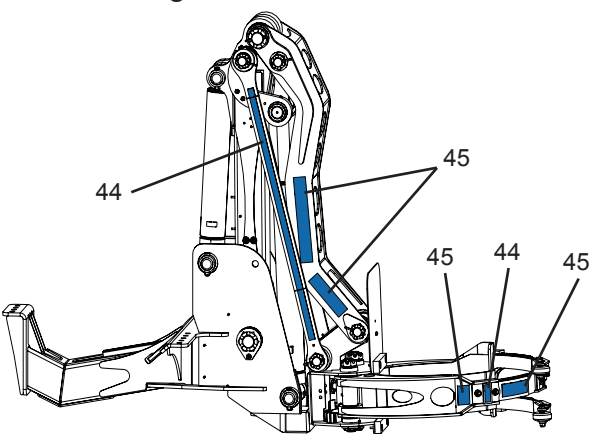


Figure 4



Tailgate Side View



Cab Side View

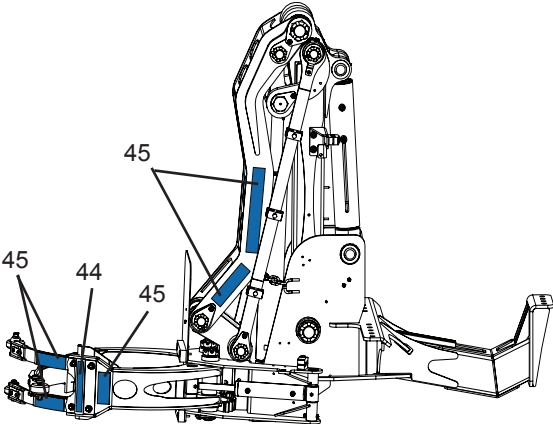
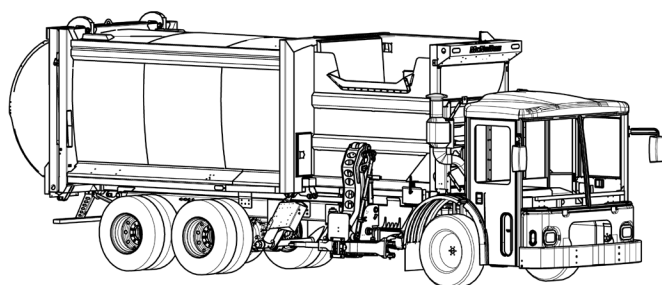


Figure 5





# Preventive Maintenance 3

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## 1.0 Preventive Maintenance

The unit must be checked or inspected each day or before each new shift of operation. Report any deficiencies to your Maintenance Department for correction by skilled service personnel.

<p><b>⚠ CAUTION</b></p> <p><b>Correct all identified deficiencies BEFORE operating the Packer. Failure to correct deficiencies may cause damage to equipment.</b></p>
---

### 1.1 DOT Pre-Trip

Perform pre-trip inspection of chassis and refuse vehicle according to all federal, state, and local laws.

### 1.2 Preventive Maintenance Intervals

Performing preventive maintenance on your refuse vehicle will prolong the life of its equipment, help prevent expensive downtime and minimize the potential for problems arising on the route.

The following Preventive Maintenance Chart summarizes the requirements to properly maintain your refuse vehicle.

The chart specifies the recommended interval when each item should be performed.

Intervals are listed in calendar and hours-of-use increments. Maintenance should be performed at the increment that occurs first.

The preventive maintenance intervals listed under the **Service** group heading are the maximum days or hours allowed for each maintenance procedure. Continue to repeat the maintenance procedures at the listed intervals.

<p><b>NOTE</b></p> <p><b>If the Packer is operated more hours per day or double-shifted, the maintenance interval must be adjusted accordingly.</b></p>
---

The Preventive Maintenance Chart identifies the responsibilities to be performed by both the operator and service personnel.

Some maintenance procedures are listed under both the **Operator** group heading and **Service** group heading.

The Daily Checks under the **Operator** group heading identify procedures that can be performed by either the operator or skilled service personnel.

All intervals listed under the **Service** group heading must be performed by skilled service personnel. Refer to the product Service Manual for description of maintenance procedures.

Maintenance procedures are listed under the system of the refuse vehicle that is affected.

## LEGEND

**R** Replace      **P** Perform  
**I** Inspect      **L** Lubricate  
**T** Torque      **C** Clean

Operator				Service			
Daily Checks	Daily (10 Hours)	Weekly (50 Hours)	Scheduled PM (150 Hours)	Semi-Annual (1250 Hours)	Annually (2500 Hours)	Bi-Annual (5000 Hours)	Every Five Years

<b>Hydraulic System</b>							
Hydraulic Oil Level	P			P			
Hydraulic System and Components	I			I			
Hydraulic Hoses	I			I			
Hydraulic Tubes and Pipes	I			I			
Breather Filter				I/R	R		
Return Line Filter					R		
Hydraulic Oil Test					P		
HOC Operation Test					P		
Main Relief Valve Setting					P		
Hydraulic Oil					R <sup>1</sup>	R <sup>2</sup>	
Reservoir Drain Plug					I/P <sup>1</sup>	I/P <sup>2</sup>	
Suction Line Strainer					R <sup>1</sup>	R <sup>2</sup>	
<sup>1</sup> Applies to Standard Hydraulic System							
<sup>2</sup> Applies to OPTIONAL Clean-Fill Hydraulic System							
<b>Electrical System</b>							
Lighting System	I			I			
Wire Harness	I			I			
Audible Back-up Alarm	I						
<b>Pneumatic System</b>							
Air Hoses and Fittings	I			I			
Coalescing Filter	P			I/R	R		
MAC Valves					L		
<b>Mechanical</b>							
Refuse Vehicle Body and Components	I			I			
Tailgate Seal Condition	I			I			
Tailgate Lock Clearance				I			
Pack and Sweep Assembly				I			
Pack Assist Panel				I			
Arm Assembly		I					
Grabber Fingers and Wheels		I					
Pusher Axle Lug Nuts			T				
<b>Operation</b>							
Refuse Vehicle Controls	P			P			
Trash Behind Pack and Sweep	I/P			I/P			
Safety Signs	I						
<b>Lubrication</b>							
Daily		L					
Scheduled PM				L			

## 2.0 Daily Checks for Preventive Maintenance

### 2.1 Hydraulic System

#### SAFETY NOTICE

Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

#### 2.1.1 Hydraulic Oil Level

- **Daily Checks** - The oil level is check by the operator or skilled service personnel.

#### NOTE

**Check hydraulic oil level during start-up when the oil temperature is still cold.**

The gauge contains a thermometer which indicates the temperature of the hydraulic oil in the reservoir. The reservoir could have one of two gauges. The first type (Figure 1) is distinguished by the word "LOW" below the sight glass. The second type (Figure 2) does not have the word "LOW" on the gauge.

The hydraulic oil must be checked with all the hydraulic cylinders in the fully RETRACTED position.

On a reservoir with a temperature/level sight gauge option (Figure 1), oil level at 60 - 70°F should be at the black line in the center of the green zone (Item 1). Oil should not be above the "Max Fill Hot" line (Figure 1, Item 2) when the system is at operating temperature. If there is too much oil in the reservoir (above the "Max Fill Hot" line), there is a possibility of the oil coming out of the breather at the top of the hydraulic reservoir. Do not operate the system with oil below the "low" line (Figure 1, Item 3) or damage to the system may result.

#### CAUTION

**Do not operate the hydraulic system with oil below the "low" line on the temperature/level sight gauge.**

**Damage to the system may result.**

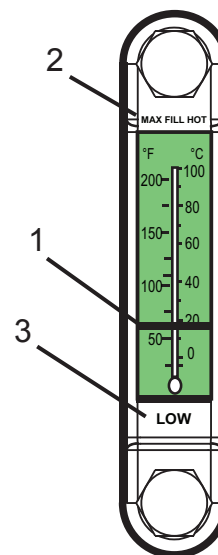


Figure 1

The second type of temperature/level sight gauge (Figure 2, Item 1) will not have the word "LOW". Keep the oil level to the top of the black line (Full) (Figure 2, Item 2), but don't over fill. If the oil level gets to the red line (Figure 2, Item 3), oil must be added.

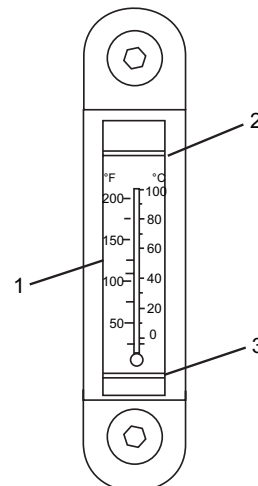


Figure 2

## 2.1.2 Hydraulic System and Components

- **Daily Checks** - The hydraulic system and components are inspected by the operator or skilled service personnel.

Inspect the hydraulic system and components for leaks and damage. Inspect around all fittings and connections. Look for any fresh puddles or drips under the refuse vehicle.

Ensure that all components are securely mounted and that all bolts and nuts are in place and secure.

Inspect for cracks or other damage to the mounting brackets.

## 2.1.3 Hydraulic Hoses, Tubes, and Pipes

- **Daily Checks** - The hydraulic hoses, tubes, and pipes are inspected by the operator or skilled service personnel.

Inspect hydraulic hoses, tubes, and pipes for damage and proper clearance with other components. If you find hoses with any such adverse conditions or damage, they must be replaced before the vehicle is returned to service.

The following are examples of hydraulic hose damage to inspect for:

- Bulging (Figure 3, Item 1)
- Cracking (Figure 3, Item 2)
- Cuts (Figure 3, Item 3)
- Abrasion (Figure 3, Item 4)
- Twisting (Figure 3, Item 5)
- Bending (Figure 3, Item 6)

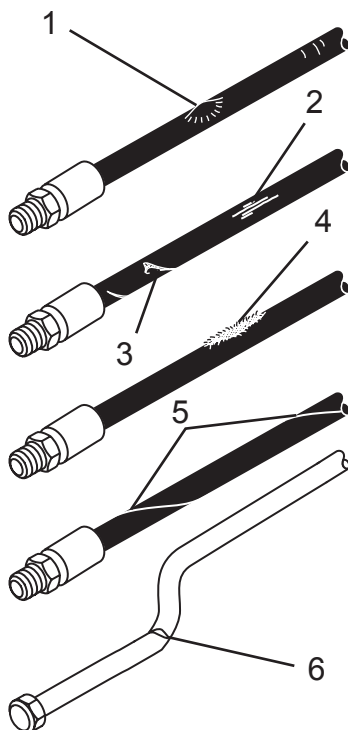


Figure 3

## 2.2 Electrical System

### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

### 2.2.1 Lighting System

- **Daily Checks** - The lighting system is inspected by the operator or skilled service personnel.

Check to ensure that all exterior lights on the refuse vehicle and chassis are functioning correctly. Replace any burned-out bulbs with the same type.

### 2.2.2 Wire Harness

- **Daily Checks** - The wire harnesses are inspected by the operator or skilled service personnel.

Inspect the wiring harnesses for damage and proper clearance with other components.

The following are examples of wire harness damage to inspect for:

- Cracks (Figure 4, Item 1)
- Cuts (Figure 4, Item 2)
- Abrasion (Figure 4, Item 3)
- Twisting (Figure 4, Item 4)

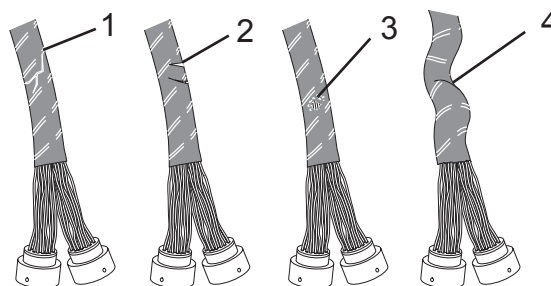


Figure 4

## 2.3 Pneumatic System

### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

### 2.3.1 Pneumatic Lines and Fittings

- **Daily Checks** - The pneumatic lines and fittings are inspected by the operator or skilled service personnel.

Check the pneumatic lines and fittings for leaks, wear, abrasion, damage, and proper clearance. Ensure that all fittings are secure.

## 2.3.2 Coalescing Filter

- **Daily Checks** - The coalescing filter is drained by the operator or skilled service personnel.

1. Locate the drain fitting (Figure 5, Item 1) on the bottom of the coalescing filter.

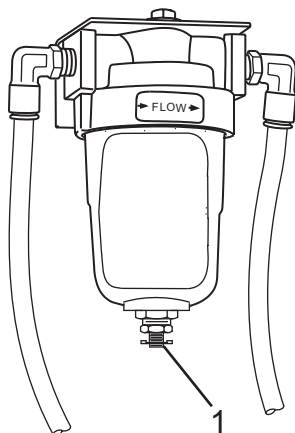


Figure 5

2. Drain the filter by turning the drain fitting counterclockwise.
3. Turn the drain fitting clockwise after all moisture and contaminants have drained from the canister.

- **Monthly or Every 200 Hours** – The coalescing filter element should be replaced by skilled service personnel.

1. Drain pneumatic system before removing filter element.
2. Remove (unscrew) the bowl assembly (Figure 6, Item 1) and O-ring (Figure 6, Item 2).
3. Remove the retainer (Figure 6, Item 3) and filter element (Figure 6, Item 4) from the head (Figure 6, Item 5).
4. Install a new filter element (Figure 6, Item 4) and retainer (Figure 6, Item 3).



### CAUTION

**Do not use aromatic solvents to clean the bowl assembly. Clean the bowl assembly using warm, soapy water only. The use of aromatic solvents will result in damage to the bowl assembly.**

5. Clean the bowl assembly (Figure 6, Item 1) using warm, soapy water.
6. Inspect the O-ring (Figure 6, Item 2). Replace if damaged.
7. Install the O-ring (Figure 6, Item 2) and bowl assembly (Figure 6, Item 1) on the filter head (Figure 6, Item 5).

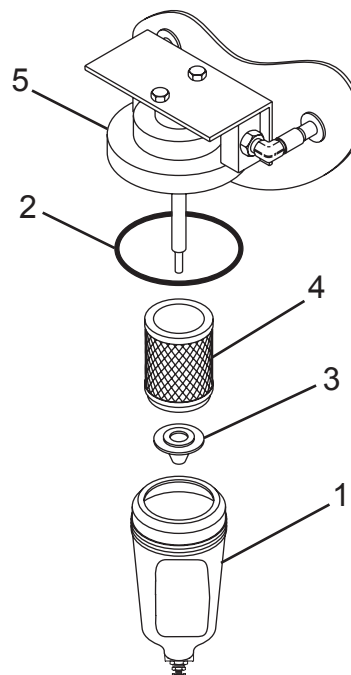


Figure 6

## 2.4 Mechanical System

### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

### 2.4.1 Refuse Vehicle Body and Components

- **Daily Checks** - The refuse vehicle body and components are inspected by the operator or skilled service personnel.

Inspect the body and all components for binding, damage, loose or missing parts.

### 2.4.2 Rubber Hopper Lip

Inspect the rubber hopper lip for tearing or excess wear. Replace as necessary. This lip helps reduce trash blow out and keeps liquids contained when dumping the can.

### 2.4.3 Tailgate Seal

- **Daily Checks** - The tailgate seal is inspected by the operator or skilled service personnel.

Inspect the tailgate seal for tears, damage or excessive wear. Inspect the mounting straps to ensure they are secure. The tailgate should be blocked open for seal inspections. See Section 4.0 of Preventive Maintenance for Propping the Tailgate.



## 2.5 Operation Maintenance

### **⚠ WARNING**

Be sure all non-operator personnel are at least 20 feet (6 meters) away from all areas of the Packer.  
Serious personal injury or death may occur.

### **⚠ DANGER**

Make sure the area above the vehicle is clear of objects and power lines before raising the arm.  
Serious personal injury or death may occur.

### 2.5.1 Refuse Vehicle Controls

- **Daily Checks** - The refuse vehicle controls are checked for proper operation by the operator or skilled service personnel.

Operate all functions to validate they are operational. Verify that all indicator lights and alarms are operational.

## 2.6 Trash Behind the Pack and Sweep

- **Daily Checks** - The refuse vehicle is inspected for trash behind the pack and sweep by the operator or skilled service personnel.

When the refuse vehicle is operated on the route, trash can pass-by the pack and sweep. If the trash is not cleaned from behind the pack and sweep, the refuse vehicle can be damaged.

1. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

### **⚠ WARNING**

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

2. Pull the top lever down, which will push the bottom lever up (Figure 7, Item 1).
3. Open the clean out door (Figure 8, Item 1).
4. Inspect behind the pack and sweep for accumulation of trash.

5. Without reaching your arm into the hopper, remove the trash from behind the pack and sweep using the appropriate clean out tool.

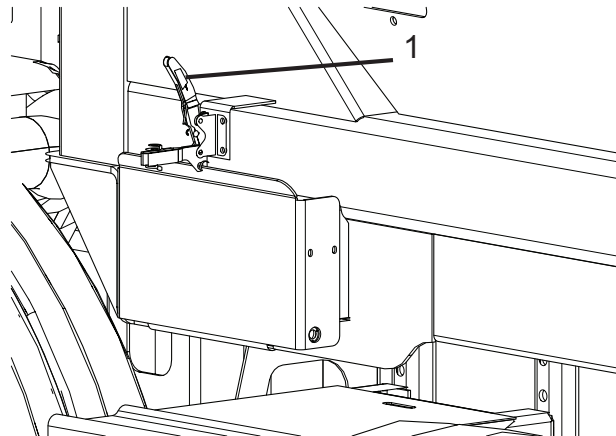


Figure 7

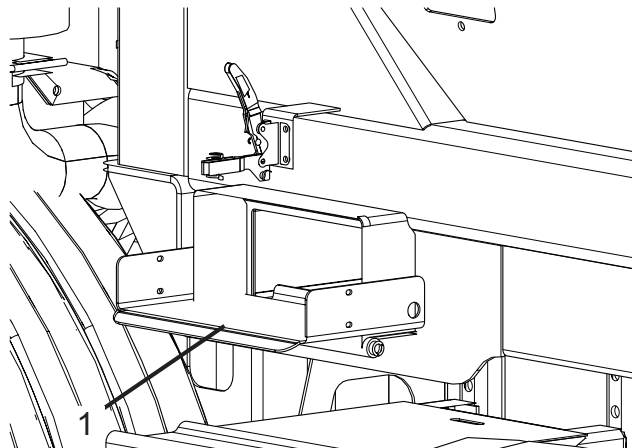


Figure 8

6. After the trash is removed, close and secure the clean out door.
7. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

## 2.7 Safety Signs

- **Daily Checks** - A complete walk around of the vehicle to inspect safety signs should be performed every day before operation. If any safety signs are damaged, illegible, or missing, they must be replaced before operation.

For the proper location and part numbers of safety signs for the refuse vehicle, see the Safety Section of this manual. If you are unable to determine the proper safety sign or its placement on the refuse vehicle, call McNeilus Truck and Manufacturing, Inc. at 888-686-7278 for assistance. Contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 or visit [www.streetsmartparts.com](http://www.streetsmartparts.com) to order replacement safety signs. Use only McNeilus replacement safety signs.

For information on any of the chassis safety decals, please contact the chassis manufacturer.



## 3.0 Semi-Annual Preventive Maintenance

### 3.1 MAC Valve Internal Lubrication

- **Semi-Annual Maintenance** - Internally lubricate the MAC valves.
1. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
  2. Locate the MAC valves on the vehicle.
  3. Disconnect the inlet line (Figure 9, Item 1).
  4. Insert about one tablespoon of automatic transmission fluid (ATF) into the inlet line. **NOTE:** Do not use synthetic fluid.
  5. Reconnect the inlet line, pushing until it clicks into place.
  6. The addition of Internal lubrication fluid is complete.

When the air valve reaches 90 PSI, the air will force the lubrication fluid through the valve stack and to the connected valve stack.

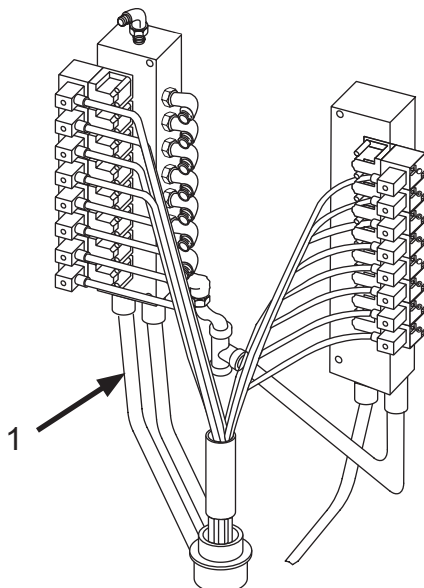


Figure 9

## 4.0 Hydraulic System

### 4.1 Hydraulic Oil Capture and Disposal

When working with the hydraulic system, be sure to properly and safely capture and dispose of any hydraulic oil in accordance with all applicable local, state, or federal regulations.

### 4.2 Hydraulic Oil Requirements

The lubrication requirements for your McNeilus refuse

vehicle are common for hydraulic oils. Hydraulic oils differ from other oils. Hydraulic oils have additives to inhibit water, rust, oxidation, and foaming.

The table below lists the hydraulic oil specifications.

Hydraulic Oil Specifications	
ISO Grade	46
Viscosity @ 40°C, cSt	46
Viscosity @ 100°C, cSt	6.7
Viscosity Index (TYP)	97
Pour Point	-20°F (-29°C)
Gravity, API	30.1
Zinc	416 PPM
Phosphorus	334 PPM
Calcium	71 PPM

### 4.3 Standard Hydraulic System

#### 4.3.1 Hydraulic Oil Reservoir

Hydraulic oil reservoir styles may vary due to the various chassis configurations, but all reservoirs are either 40 or 50 gallon capacity, typically use the same style filter (Figure 10, Item 1) and breather (Figure 10, Item 2), and are mounted to the side of each chassis frame.

The drain plug (Figure 10, Item 3) is a magnetic plug located at the bottom of the reservoir.

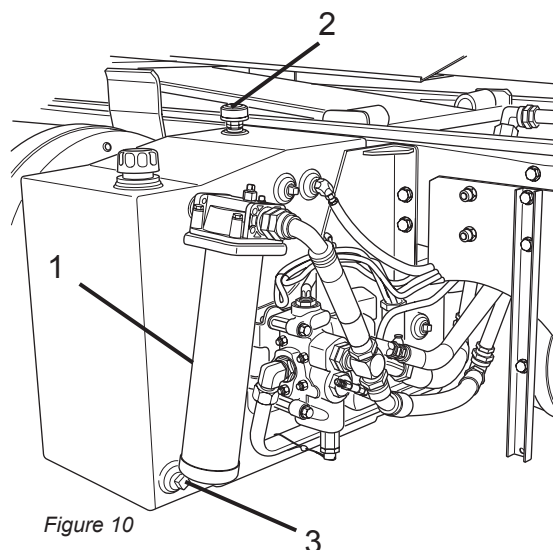


Figure 10

The level sight gauges (Figure 11, Item 1) or the optional temperature/level sight gauge are located on either side of the reservoir.

Make sure the shut-off valve (Figure 11, Item 2) is fully open and not partially closed. A nylon strap (Figure 11, Item 3) must be installed on the shut-off valve to prevent vibration from closing the shut-off valve or inadvertent closing of the valve.

Anytime the shut-off valve is closed and reopened, the nylon strap must be replaced.

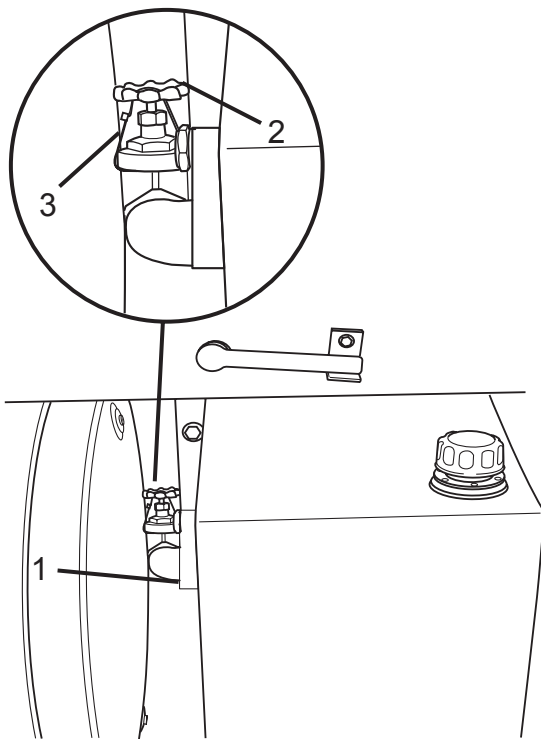


Figure 11

## 4.3.2 Adding Hydraulic Oil

With all hydraulic functions in their home positions, pack and sweep in HOME or retracted position, tailgate in DOWN position, and the arm in TRAVEL position, check the hydraulic oil level.

To add hydraulic oil, retract all cylinders, remove the filler cap (Figure 12, Item 1) and add oil as necessary.

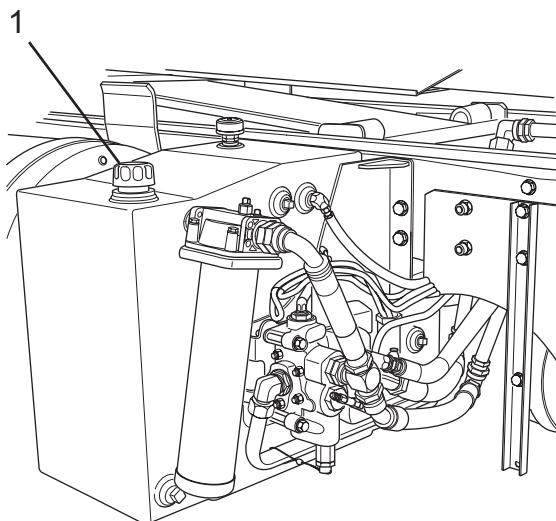


Figure 12

### NOTE

When adding hydraulic oil, take every precaution to prevent contaminants from entering the hydraulic system. Cleanliness is extremely important when working with hydraulics.

### NOTE

If it is necessary to add hydraulic oil often or in large quantities, inspect the hydraulic system for leaks and repair before operating the refuse vehicle.

## 4.4 Clean Fill Hydraulic System (Optional)

Some units are equipped with a clean fill option. The fill cap is replaced by two quick disconnects. To add oil, a mobile filtration system is required. The quick disconnects are provided to connect the mobile filtration system. One quick disconnect (Figure 13, Item 1) is located in the hydraulic suction line to the hydraulic pump or in the hydraulic reservoir. A second quick disconnect (Figure 13, Item 2) is located in the hydraulic return line prior to the hydraulic return filter. Oil that is added is filtered through the hydraulic return filter.

The level sight gauges (Figure 13, Item 3) are located on either side of the reservoir.

The return line filter of the clean-fill system is equipped with a test port (Figure 13, Item 4). The test port is used to withdraw a hydraulic oil sample.

### 4.4.1 Adding Hydraulic Oil

With all hydraulic functions in their home positions, Pack and Sweep in home or retracted position, tailgate in down position, and the arm in the travel position, check the hydraulic oil level.

To add hydraulic oil, connect the mobile filtration system to the quick disconnects (Figure 13, Items 1 and 2).

### NOTE

When adding hydraulic oil, take every precaution to prevent contaminants from entering the hydraulic system. Cleanliness is extremely important when working with hydraulics.

### NOTE

If it is necessary to add hydraulic oil often or in large quantities, inspect the hydraulic system for leaks and repair before operating the refuse vehicle.

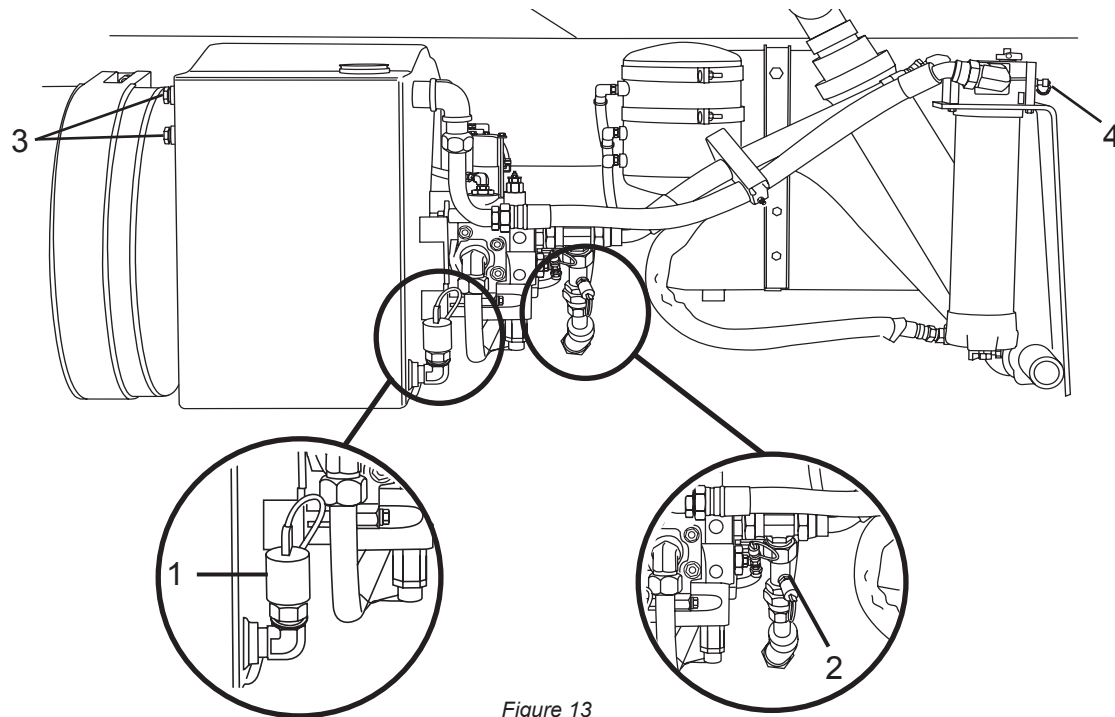


Figure 13

## 5.0 Propping the Body for Maintenance

When performing maintenance of the chassis that requires the body to be raised, the following procedure must be followed to raise and prop the body.

### **⚠ WARNING**

Be sure all non-operator personnel are at least 20 feet (6 meters) away from all areas of the Packer.  
Serious personal injury or death may occur.

### **⚠ DANGER**

Make sure the area above the vehicle is clear of objects and power lines before raising the arm.  
Serious personal injury or death may occur.

### **⚠ DANGER**

**PACKER BODY MUST BE EMPTY** and body props employed when servicing Packer body in the raised position. Body props are meant to support only the empty body.  
Never overload.  
Failure to empty body or employ body props may cause serious personal injury or death.

### 5.1 Engaging the Body Prop

1. Ensure the body is unloaded. **NEVER lift or prop a loaded body.**
2. Start the engine and raise the body approximately 2.5 ft.
3. Shut off the engine and disable the vehicle functions.
4. Move the bracket that holds the prop lever up to the rear of the refuse vehicle and swing the prop lever (Figure 14, Item 1) down.
5. Position the props (Figure 14, Item 2) above the pockets (Figure 14, Item 3) on the chassis frame.
6. Turn the battery chassis switch to ON.

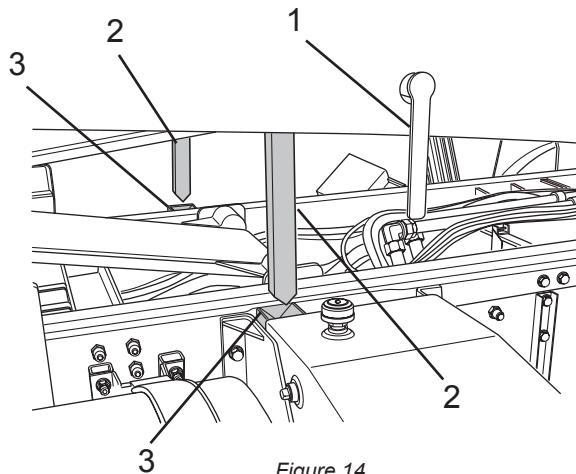


Figure 14

7. Start the chassis engine.
8. Lower the body until both props (Figure 15, Item 1) are securely seated into the pockets on the chassis frame.

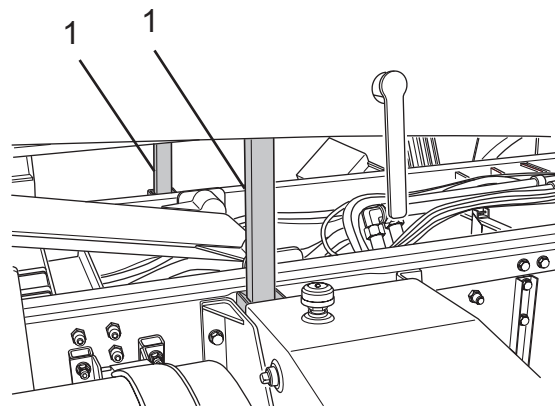


Figure 15

9. Shut off the engine and disable the vehicle functions.
10. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

### **⚠ WARNING**

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

## 5.2 Disengaging the Body Prop

After completing the maintenance on the chassis that required the body to be propped, the following procedure must be followed to disengage the props and lower the body.

1. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
2. Start the chassis engine and raise the body as needed to provide the necessary clearance to remove the props from the pockets.
3. Disable the vehicle functions.

### **WARNING**

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

4. Push the prop lever (Figure 16, Item 1) up and move the bracket towards the front of the refuse vehicle to secure the prop lever in place.

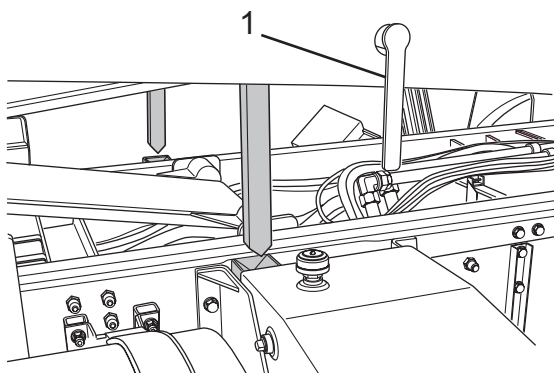


Figure 16

5. Turn the chassis battery switch to **ON**. Lower the body onto the frame.
6. Lower the body the rest of the way down until the refuse vehicle body is resting on the chassis frame.

## 6.0 Propping the Tailgate for Maintenance

When performing maintenance procedures that require the tailgate to be open, the following procedure must be completed to open and prop the tailgate.

### **WARNING**

**Be sure all non-operator personnel are at least 20 feet (6 meters) away from all areas of the Packer. Serious personal injury or death may occur.**

### **DANGER**

**Stand clear when the tailgate is in motion and during the unloading cycle. Do not stand under or cross under the raised tailgate. Serious personal injury or death may occur.**

### **DANGER**

**Whenever the tailgate is in a raised position, it must be securely propped or blocked so it cannot fall on anyone. Serious personal injury or death may occur.**

## 6.1 Engaging the Tailgate Prop

1. Start the engine and raise the tailgate approximately 2.5 - 3 ft.
2. Shut the chassis engine off and disable the vehicle.

### **WARNING**

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

3. Standing behind the tailgate, release the pin (Figure 17, Item 1) and swing the prop (Figure 17, Item 2) toward the truck frame.

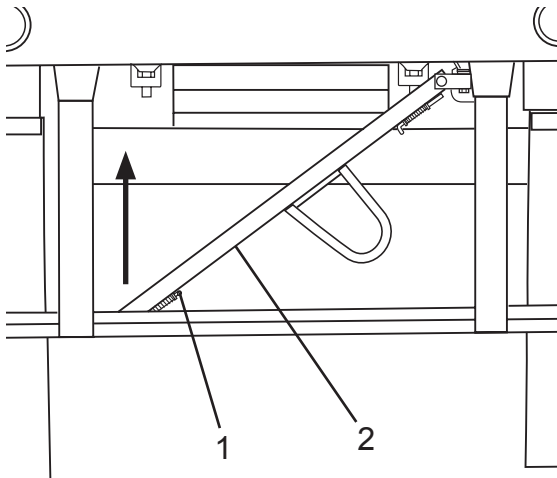


Figure 17

4. Position the end of the prop (Figure 18, Item 1) over the pocket (Figure 18, Item 2) and lock in place with spring loaded pin.

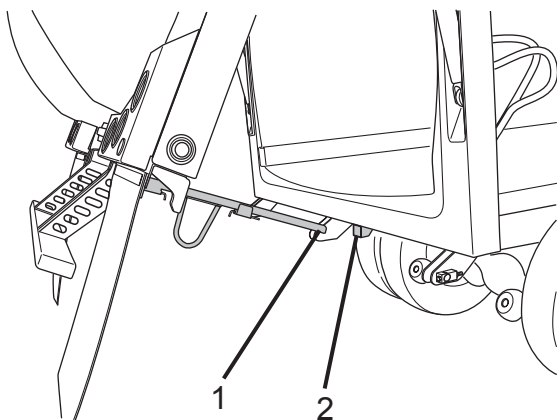


Figure 18

5. Turn chassis battery switch ON.

6. Start chassis engine and lower the tailgate until the prop is fully seated in the pocket (Figure 19, Item 1).

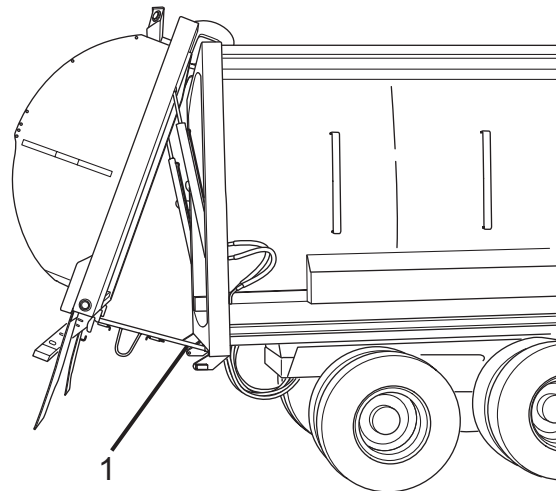


Figure 19

7. Shut the chassis engine off and disable the vehicle.
8. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

## ⚠ WARNING

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

## ⚠ DANGER

**Verify that the tailgate props are properly seated in the pockets off the body compartment.**

**Serious personal injury or death may occur.**

## ⚠ CAUTION

**Do not POWER DOWN the tailgate against the props.**

**Damage may occur to the props.**



### 6.2 Disengaging the Tailgate Prop

After completing the maintenance procedures on the body that require the tailgate to be propped, the following procedures must be followed to remove the prop and close the tailgate.

1. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
2. Open the tailgate as needed to provide the necessary clearance to disengage the prop from the pocket in the body compartment.
3. Disable the vehicle functions.

#### **WARNING**

**Packer must be disabled by the following steps before proceeding.**

1. Place transmission in **NEUTRAL**.
2. Apply chassis parking brake.
3. Shut engine **OFF**.
4. Remove chassis ignition key and maintain in personal possession.
5. Turn chassis **BATTERY** switch **OFF**.

**Failure to disable the Packer may result in serious personal injury or death.**

4. Standing behind the tailgate, remove the prop from the pocket and swing the prop (Figure 20, Item 1) away from chassis frame to the stored position and install retaining pin (Figure 20, Item 2).

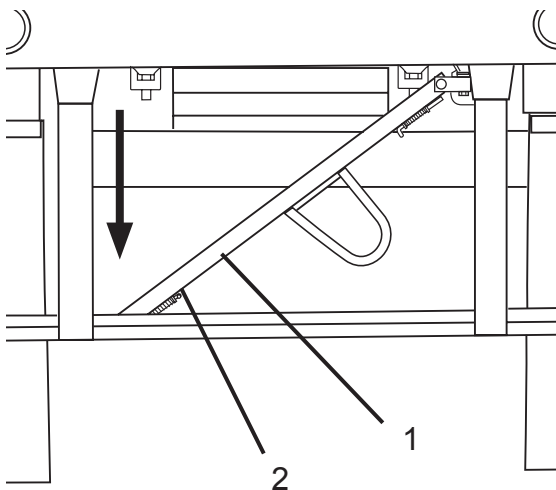


Figure 20

5. Turn chassis battery switch **ON**.
6. Start the chassis engine.
7. Close the tailgate.

### 6.3 Engaging the Side Tailgate Props

When performing maintenance procedures that require the tailgate to be open, the following procedure must be completed to open and prop the tailgate.

1. Disengage the pin securing the tailgate prop to the tailgate in the stored position on both sides of the tailgate (Figure 21).

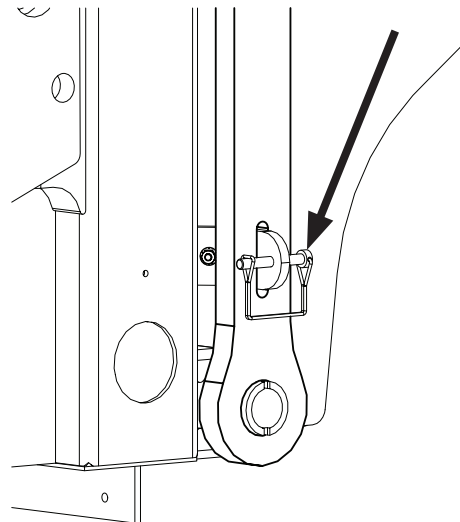


Figure 21

2. Lower the tailgate prop so that it does not need to travel far when the tailgate is opened (Figure 22). Do this on both sides.

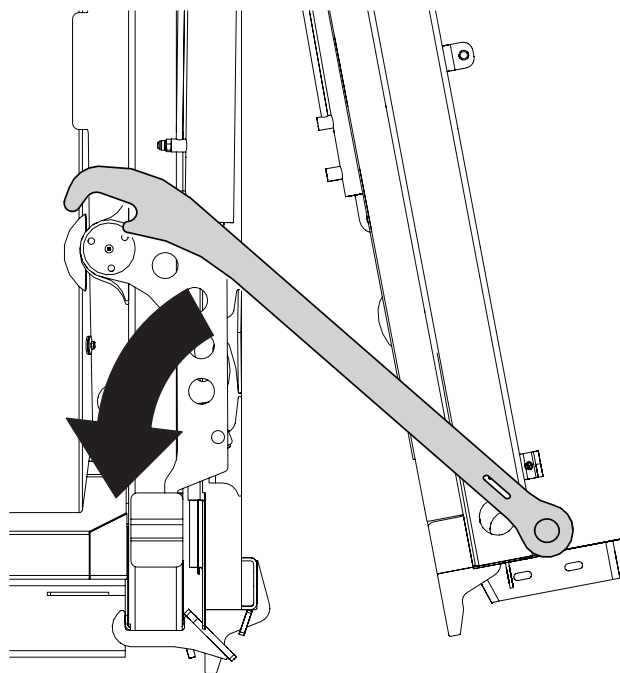


Figure 22

- Using the in-cab rocker switch, start to open the tailgate (Figure 23, Item 1).

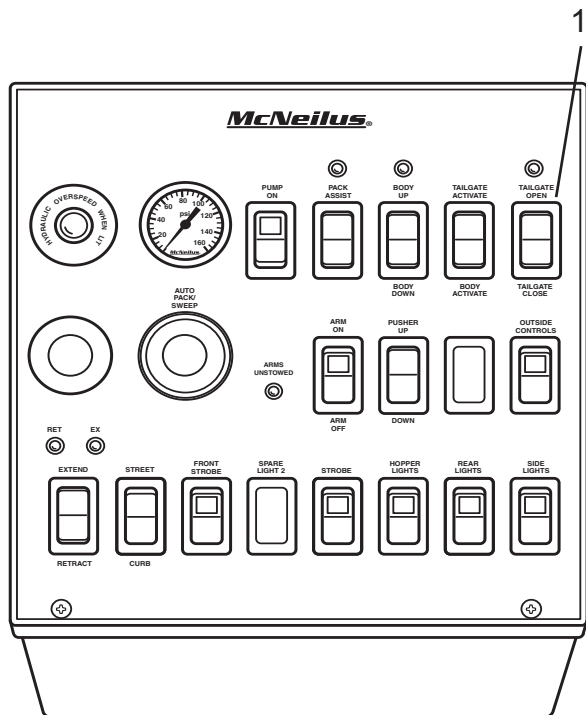


Figure 23

- Use the truck's side mirrors to watch the tailgate open and determine when the tailgate props are engaged.
- Stop opening the tailgate when the tailgate props are engaged (Figure 24).

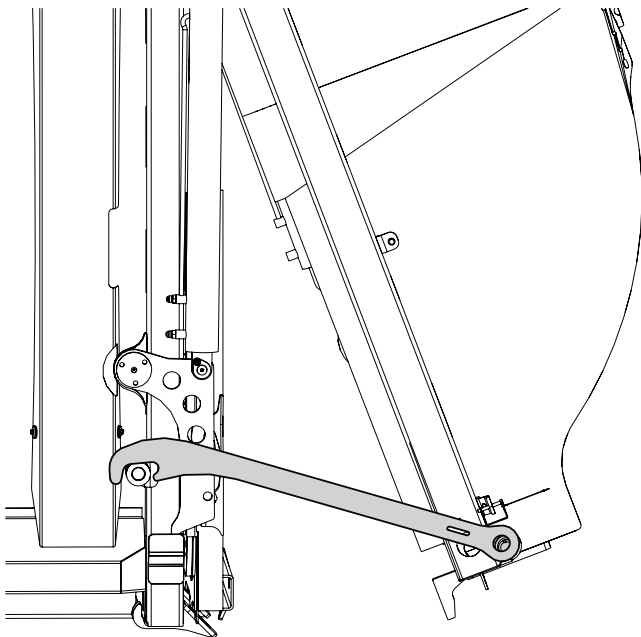


Figure 24

- Perform your company's Lockout/Tagout per your company's procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.

## 6.4 Disengaging the Side Tailgate Props

After completing the maintenance procedures on the body that required the tailgate to be propped, the following procedure must be completed to disengage the props and close the tailgate.

- Remove your company's Lockout/Tagout per your company's procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
- Using the in-cab rocker switch, open the tailgate as needed to provide the necessary clearance to disengage the props (Figure 25, Item 1).

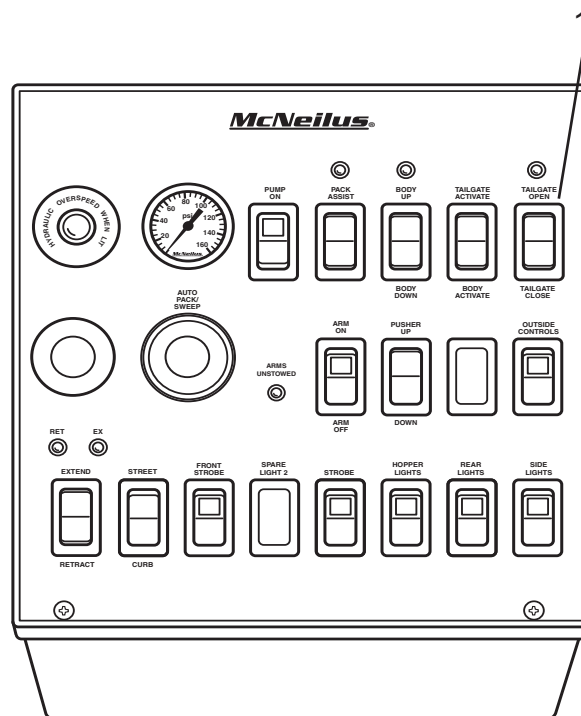


Figure 25



3. Push the prop into the stored position (Figure 26).

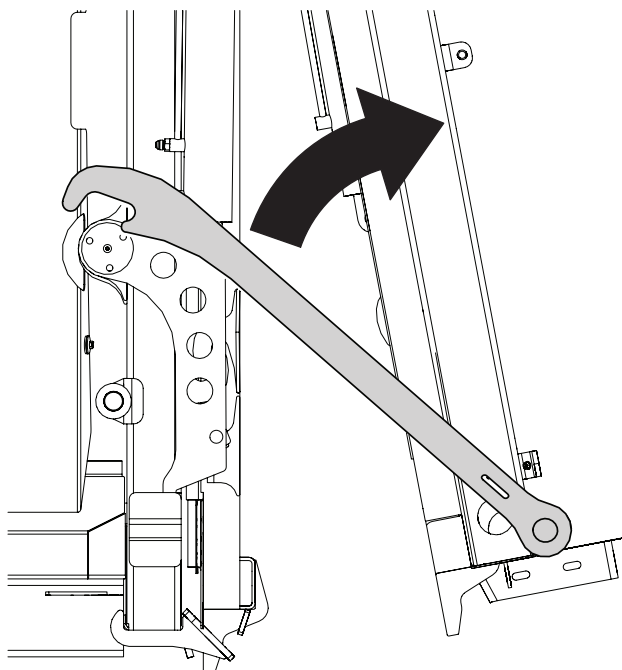


Figure 26

4. Re-engage the pin securing the tailgate prop to the tailgate in the stored position on both sides of the tailgate (Figure 27).

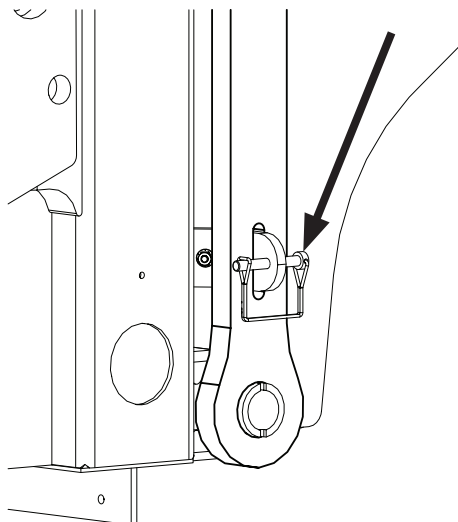


Figure 27

5. Using the in-cab keypad, lower the tailgate until it is closed (Figure 28, Item 1).

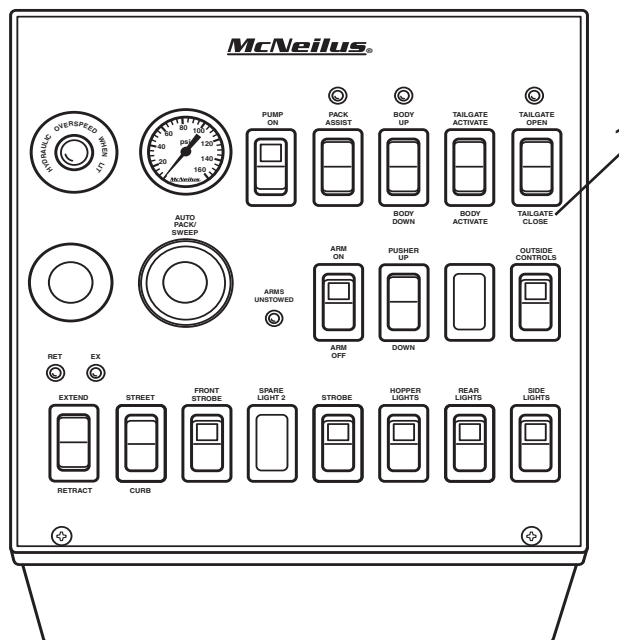


Figure 28

## 7.0 Arm Assembly Maintenance

When properly maintained, the AutoReach arm assembly will provide reliable and productive operation.

The arm assembly performs hundreds of cycles per day on a typical route. This application requires that all lubrication points be greased daily or every 10 hours, whichever occurs first. When greasing, use a NLGI #2 Extreme Pressure grease.

The AutoReach arm and grabber are assembled using pins, tapered roller bearings, and spanner nuts.

### 7.1 Spanner Nut Torque Interval

The torque on the spanner nuts (Figure 29) must be inspected and re-torqued at a Preventive Maintenance interval of 150 hours or three (3) weeks of use, whichever occurs first. Using a spanner socket, check and torque the spanner nut to 40 ft.-lbs.

Two sizes of spanner nuts are used on the AutoReach arm assembly (Figure 30). The larger spanner nuts require the use of #10 size spanner socket, McNeilus part number 0002045. The smaller spanner nuts require the use of a #7 size spanner socket, McNeilus part number 0120955.

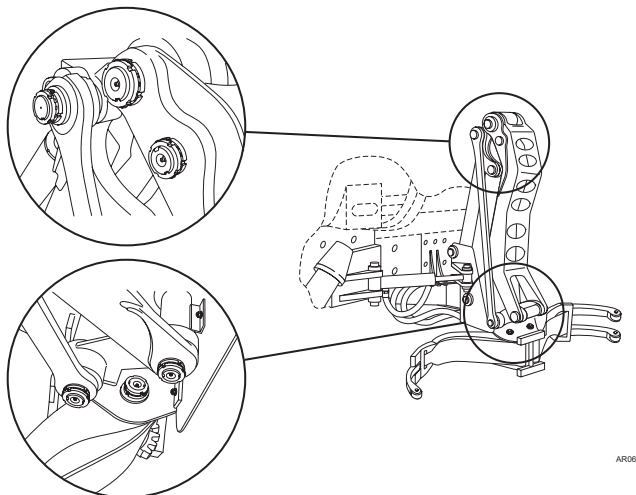


Figure 29

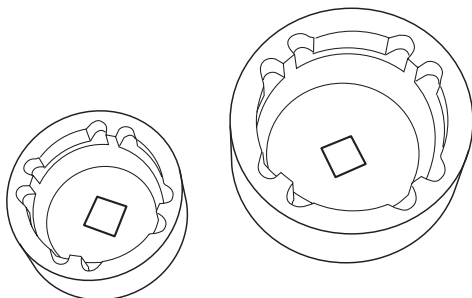


Figure 30

### 7.2 Castle Nut Torque Interval

The torque on the castle nuts (Figure 31) must be inspected and re-torqued at a Preventive Maintenance interval of 150 hours or three (3) weeks of use, whichever occurs first, and after replacing the grabber.

To re-torque a castle nut,

1. Remove and retain the roller pin from the castle nut on the nut lock side.
2. Remove and retain the nut lock.
3. Use a 2-1/4" or 3" socket wrench to hold the castle nut on the cotter pin side when torquing on the roller pin side.
4. Torque the castle nut to 40 ft.-lbs using a torque wrench. Do not over-torque.
5. Reinstall the nut lock.
6. Reinstall the roller pin by rotating the nut counterclockwise until the pin hole is showing to replace the pin.
7. On the other side of the arm, remove and retain the cotter pin.
8. Torque the castle nut to 40 ft.-lbs using a torque wrench. Do not over-torque.
9. Reinstall and re-bend the cotter pin, or discard and use a new cotter pin.

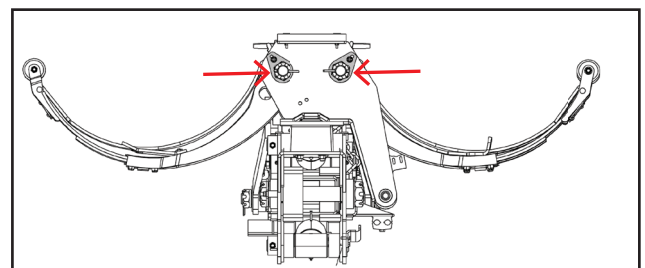
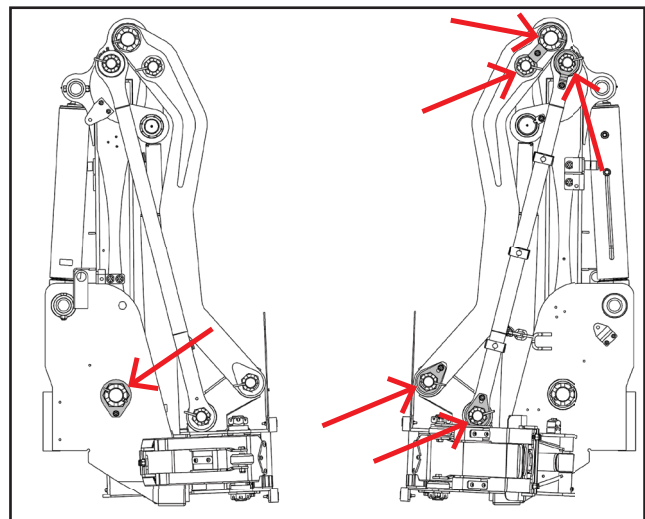


Figure 31

## 8.0 Lubrication Maintenance

### 8.1 Daily Lubrication

Lubricate all the following points with a high quality EP No. 2 lithium grease.

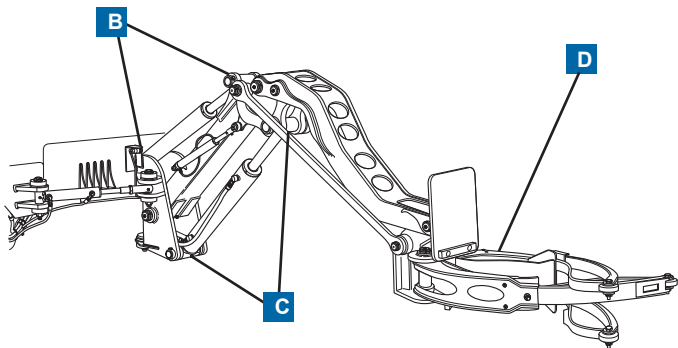
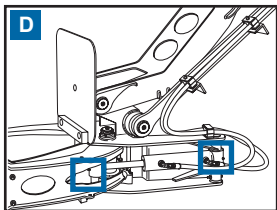
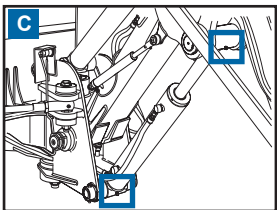
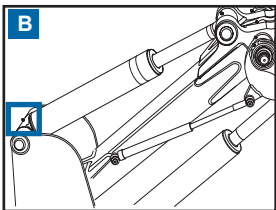
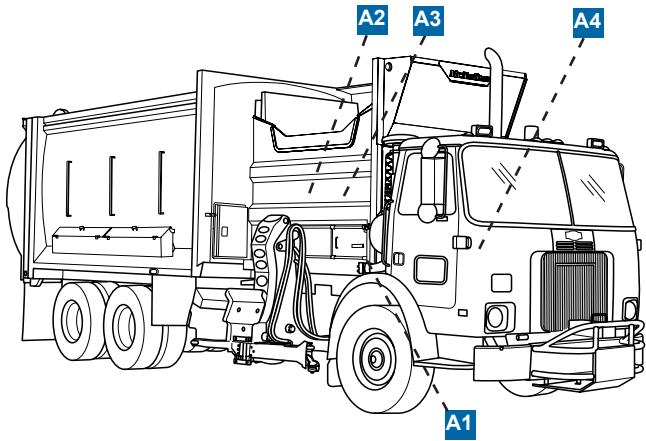
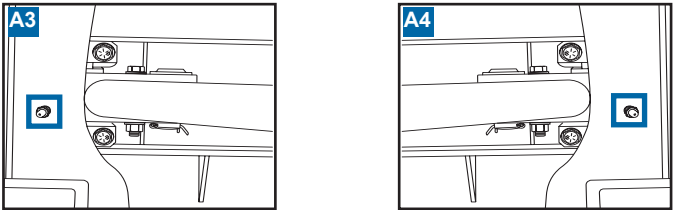
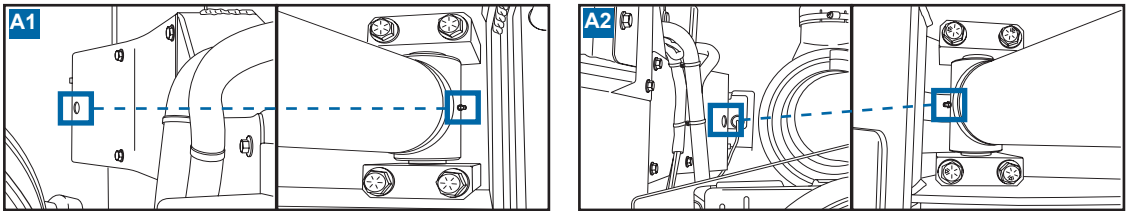
Daily lubrication intervals are based on a 10-hour day. If the refuse vehicle is operated more hours per day or double shifted, the maintenance interval must be adjusted accordingly.

#### SAFETY NOTICE

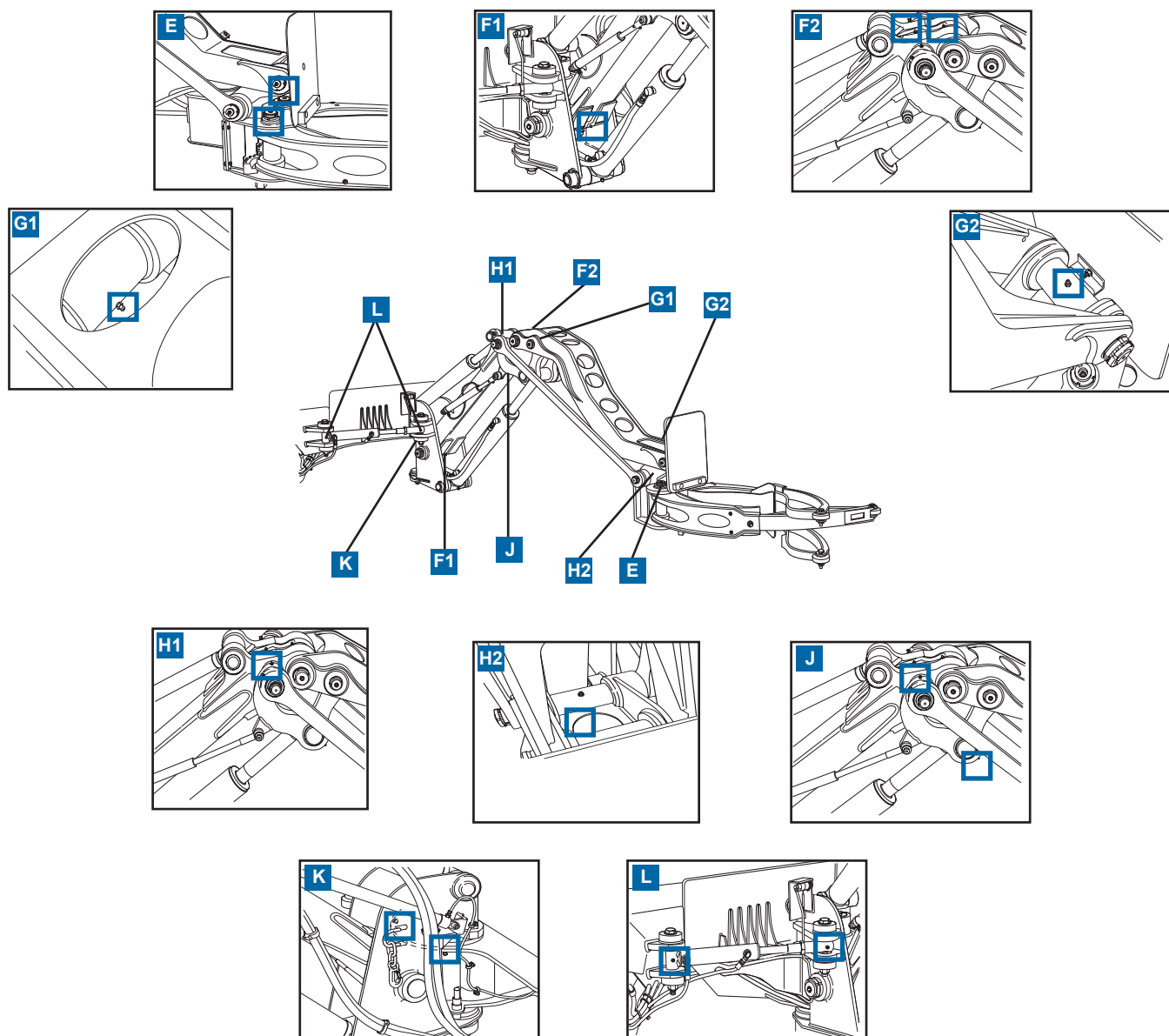
**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

If your refuse vehicle is equipped with a tag axle, refer to the Operator and the Maintenance Manual supplied by the manufacturer for the proper lubrication and maintenance.

Daily Lubrication Points		Lubricate Daily or Every 10 Hours	
Ref.	Description	No. of Fittings	Comments
A1	Pack and Sweep Cylinders - Curb Side - Base End	1	Two Cylinders - One Per Side
A2	Pack and Sweep Cylinders - Street Side - Base End	1	Two Cylinders - One Per Side
A3	Pack and Sweep Cylinders - Curb Side - Rod End	1	Two Cylinders - One Per Side
A4	Pack and Sweep Cylinders - Street Side - Rod End	1	Two Cylinders - One Per Side
B	Reach Cylinder - Rod End	1	
B	Reach Cylinder - Base End	1	
C	Tip Cylinder - Rod End	1	
C	Tip Cylinder - Base End	1	
D	Grabber Cylinder - Rod End	1	
D	Grabber Cylinder - Base End	1	



Daily Lubrication Points		Lubricate Daily or Every 10 Hours	
Ref.	Description	No. of Fittings	Comments
E	Grabber Finger Pivot Pins	2	
F1	Primary Arm Pivot Pin	1	
F2	Primary Arm Pivot Pins	2	
G1	Secondary Arm Pivot Pin	1	
G2	Secondary Arm/Grabber Pivot Pin	1	
H1	Link Arm Upper Pivot Pin	2	Two Link Arms - One Per Side
H1	Link Arm Lower Pivot Pin	1	
J	Dog Leg Link Pivot Pins	4	Two Dog Leg Links - One Per Side
K	Arm Swing Pivot Pin	2	(1) Fitting On Unit Prior To 2000
L	Swing Cylinder - Rod End (Optional)	1	
L	Swing Cylinder - Base End (Optional)	1	



## 8.2 Scheduled PM Lubrication

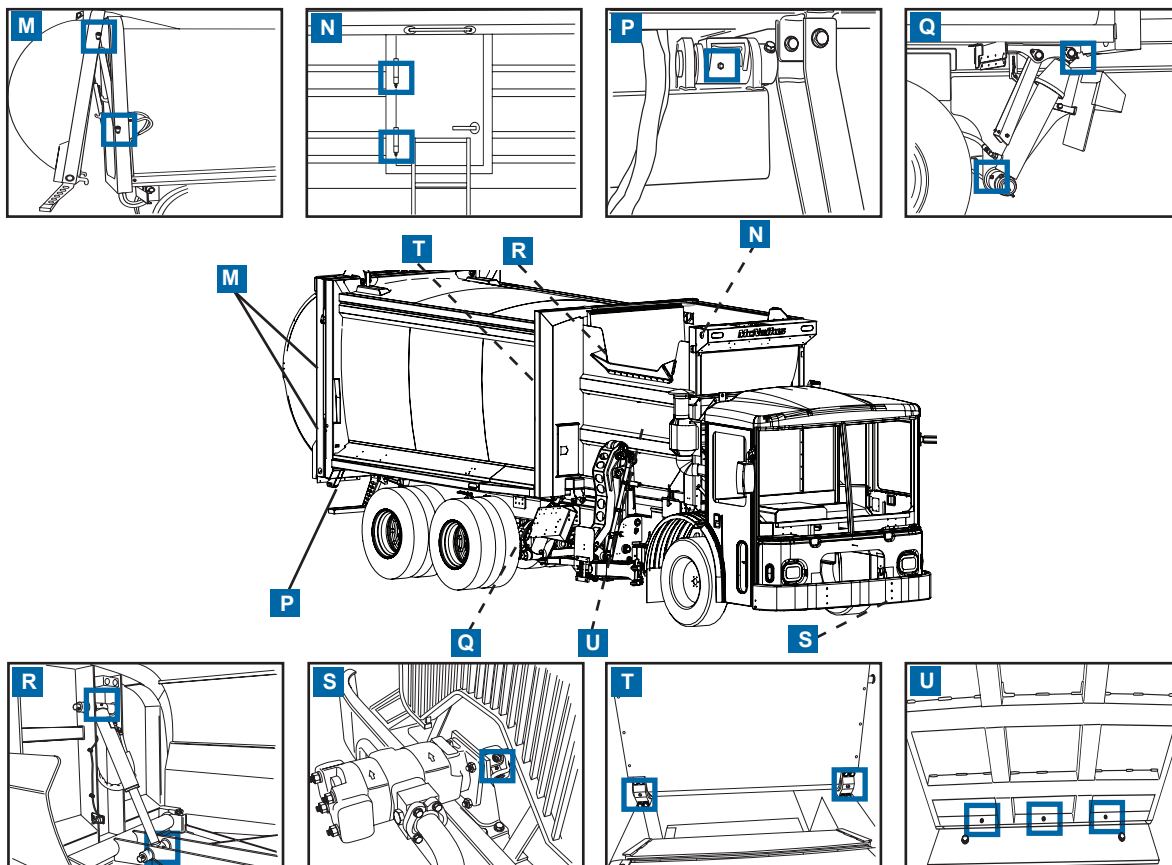
Lubricate all the following points with a high quality EP No. 2 lithium grease.

Scheduled PM lubrication intervals are based on three (3) weeks or 150 hours. If the refuse vehicle is operated more hours or double shifted, the maintenance interval must be adjusted accordingly.

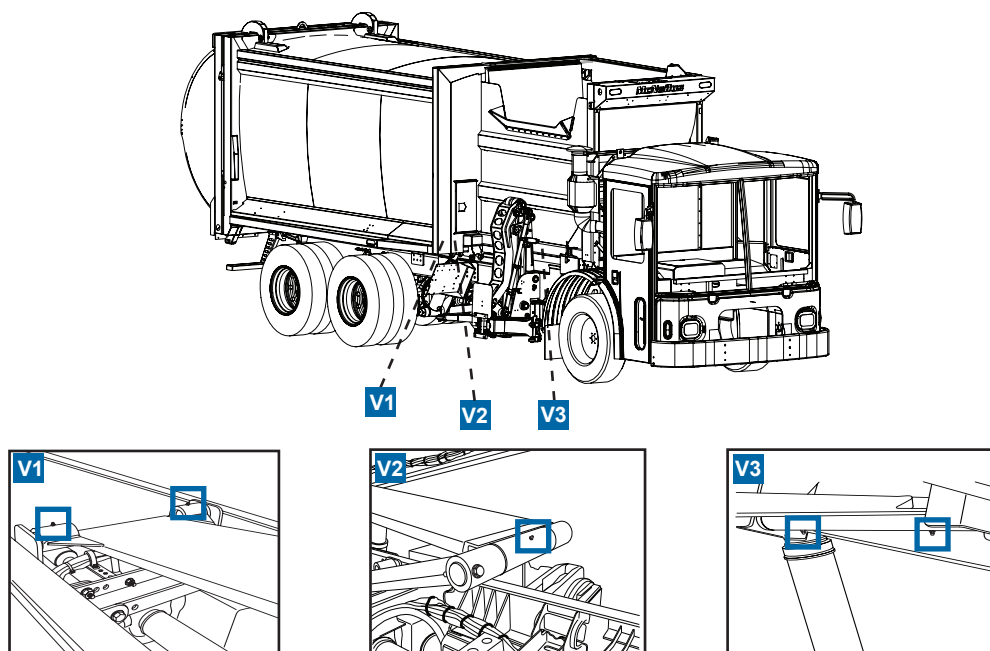
### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

Scheduled PM Lubrication Points		Lubricate Every 3 Weeks or 150 Hours	
Ref.	Description	No. of Fittings	Comments
M	Tailgate Cylinder - Base End	2	Two Cylinders - One Per Side
M	Tailgate Cylinder - Rod End	2	Two Cylinders - One Per Side
N	Side Door Hinge Pin	2	Two Hinge Pins - If Equipped
P	Body Pivot Pin	2	Two Pivot Pins - One Per Side
Q	Body Dump Cylinder - Base End	2	Two Cylinders - One Per Side
Q	Body Dump Cylinder - Rod End	2	Two Cylinders - One Per Side
R	Packer Assist Cylinder - Base End	1	
R	Packer Assist Cylinder - Rod End	1	
S	PTO Shaft U-Joints	3	
T	Pack Assist Panel Pivot Pins	2	
U	Follower Hinge	3	Side access panel to lubricate remotely.



Scheduled PM Lubrication Points		Lubricate Every 3 Weeks or 150 Hours	
Ref.	Description	No. of Fittings	Comments
V1	Lower Stabilizer Pivot	2	
V2	Middle Stabilizer Pivot	1	
V3	Upper Stabilizer Pivot	2	





## 9.0 Torque Standards

Always torque fasteners and hydraulic line fittings to the recommended specifications. Failure to do so can cause a part to fail, which may result in serious injury or death. Do not under or over-torque nuts, bolts, or hydraulic fittings to compensate for not having a torque wrench.

When tightening bolts and hydraulic fittings, keep the following guidelines in mind.

1. All hydraulic components must have all ports plugged or capped during maintenance until assembly requires the plug or cap to be removed.
2. Do not conduct any processes that produce airborne contaminants in the general vicinity of any hydraulic system where caps and plugs are removed. These include, but are not limited to, grinding, sanding, sweeping, and painting.
3. Use caution when removing shipping plugs and caps from components that have been painted to ensure that paint chips do not fall into the port.
4. Inspect all ports prior to assembly for debris in the threads that may get pushed into the port during the installation of the fitting.
5. Avoid introducing moisture into the hydraulic system by ensuring that all components are thoroughly dry prior to assembly. Avoid using dirty, oily rags when handling fittings.
6. Visually inspect all components for obvious contamination or damage before installation. Any nicks and scratches in the sealing surfaces can create a path for leaks which could lead to component contamination and/or failure. Also, visually inspect all pipes for cracks or pin holes.
7. When required to disassemble fittings, the fittings should be cleaned and inspected for damage, and replaced as necessary before reinstalling.
8. Use properly sized wrenches for the bolt being tightened and use only calibrated torque wrenches.



## 9.1 Hydraulic Fitting Torque Specifications

When tightening hydraulics fittings, review and refer to the following sections as needed.

### 9.1.1 37° Flare (JIC) Fittings

1. Inspect both mating parts for burrs, nicks, scratches, or foreign materials.
2. Tighten swivel nut hand tight on fitting until it bottoms out the seat. Hand tight is the point at which the swivel nut will no longer thread onto the adaptor when a moderate amount of torque is applied with the hand and fingers. The fitting **MUST** be moved lightly, side to side, to eliminate any possible cocking or misalignment to ensure that the nut is completely threaded forward (hand tight) and not bound. For unexpected difficulty or larger size fittings, use a wrench to seat the nut down snugly before torquing.
3. Tighten to the appropriate torque (Table 1).
4. Inspect the tightened joint for integrity and leaks.

Table 1 - 37° Flare (JIC) Torque Values					
SAE Dash Size	Nut Hex Size	Thread Size	Torque (ft – lbs)	Torque Wrench Set Point (ft – lbs)	Flarebite Torque (ft – lbs)
-02	7/16"	5/16-24	6-7	6	8
-03	7/16"	3/8-24	8-9	8	10
-04	9/16"	7/16-20	11-12	11	14
-05	5/8"	1/2-20	15-16	15	18
-06	11/16	9/16-18	18 - 20	19	26
-08	7/8	¾-3/4-16	38-42	37	55
-10	1"	7/8-14	57-62	59	80
-12	1 1/4	1 1/16-12	79-87	83	110
-16	1 1/2	1 5/16-12	108 – 113	110	140
-20	2	1 5/8-12	127 – 133	130	190
-24	2 1/4	1 7/8-12	158 – 167	162	220
-32	2 7/8	2 ½-1/2-12	245 - 258	251	300

## 9.1.2 Straight Thread O-Ring Boss (Non-Adjustable, High Pressure ORS Adapters)

1. Install the o-ring as needed.
2. Ensure the o-ring is seated and retained properly.
3. Inspect both mating parts for burrs, nicks, scratches, or foreign materials.
4. Screw fitting by hand into port until hand tight.
5. Tighten to the appropriate torque per size using a torque wrench (Table 2).
6. Inspect the joint for integrity and leaks.

Table 2 - Straight Thread O-Ring Boss (Non-Adjustable, High Pressure ORS Adapters) Torque Values

SAE Dash Size	Torque (ft – lbs)	Torque Wrench Set Point (ft – lbs)	Reduce Torque By 30-35% for Aluminum Ports
-04	14-16	15	10
-05	18-20	19	12
-06	24-26	25	16
-08	50-60	55	36
-10	72-80	76	49
-12	125-135	130	85
-16	200-220	210	137
-20	210-280	245	159
-24	210-280 270-360	245-310	159-202

### 9.1.3 Straight Thread O-Ring Boss (Adjustable, Low Pressure JIC Adapters)

1. Install the o-ring as needed.
2. Ensure the o-ring is seated and retained properly.
3. Inspect both mating parts for burrs, nicks, scratches, or foreign materials.
4. Back off lock nuts as far as possible. Make sure back-up washer is not loose and is pushed up as far as possible.
5. Screw fitting by hand into port hand tight until back-up washer contacts face of the port.
6. To position the fitting, unscrew by the required amount, but not more than one full turn.
7. Use a wrench to hold the fitting in the desired position, tighten lock nut to the appropriate torque per size using a torque wrench (Table 3).
8. Inspect the joint for integrity and leaks.

Table 3 - Straight Thread O-Ring Boss (Adjustable, Low Pressure JIC Adapters)			
SAE Dash Size	Torque (ft – lbs)	Torque Wrench Set Point (ft – lbs)	Reduce Torque By 30-35% for Aluminum Ports
-04	13-15	14	9
-05	14-15	14	9
-06	23-24	23	15
-08	40-43	41	27
-10	43-48	45	29
-12	68-75	46	46
-16	112-123	117	76
-20	146-161	153	99
-24	154-170	162	105
-32	218-240	229	149

## 9.1.4 Pipe Thread Port

1. Inspect both mating parts for burrs, nicks, scratches or foreign materials.
2. Apply Loctite 545 thread sealant to the male threads; do not put thread sealant on the bottom two threads. Teflon tape is prohibited.
3. Screw fitting into the pipe port until hand tight.
4. Tighten to the appropriate Turns From Finger Tight (TFFT) (Table 4) per size using a wrench, taking into consideration the final position of the tube end to accept incoming tube or hose assembly. Over-tightening or backing off after tightening will cause deformation of the pipe fitting and damage to the joining fitting, flange, or component which can lead to leaks.
5. Inspect the joint for integrity and leaks.

Table 4 - Pipe Thread Port Torque Values

Dash Size	NPTF Size	TFFT
-02	1/8 - 27	2 - 3
-04	1/4 - 18	2 - 3
-06	3/8 - 18	2 - 3
-08	1/2 - 14	2 - 3
-12	3/4 - 14	2 - 3
-16	1 - 11 1/2	1.5 - 2.5
-20	1 1/4 - 11 1/2	1.5 - 2.5
-24	1 1/2 - 11 1/2	1.5 - 2.5
-32	2 - 11 1/2	1.5 - 2.5

## 9.1.5 Four Bolt Split Flange

1. Inspect both mating parts for burrs, nicks, scratches, or foreign materials.
2. Lubricate the o-ring with hydraulic oil.
3. Position the flange and the clamp halves.
4. Place lock washers on the bolts and bolt through the clamp halves.
5. Hand tighten the bolts.
6. Tighten to the appropriate torque per size using a torque wrench (Table 5).

Table 5 - Four Bolt Split Flange Torque Values

Flange Dash Size	Flange Size	Bolt Thread	Torque (ft - lbs)	Torque Wrench Set Point	Torque Wrench Set Point
-08	1/2"	5/16 - 18	15 - 19	17	17
-12	3/4"	3/8 - 16	21 - 29	25	26
-16	1"	3/8 - 16	27 - 35	31	46
-20	1 1/4"	7/16 - 14	35 - 46	41	69
-24	1 1/2"	1/2 - 13	46 - 58	52	125
-32	2"	1/2 - 13	54 - 67	61	209
-40	2 1/2"	1/2 - 13	79 - 92	85	-
-48	3"	5/8 - 11	138 - 150	144	-

7. Use a diagonal tightening sequence in small increments as shown in Figure 32.

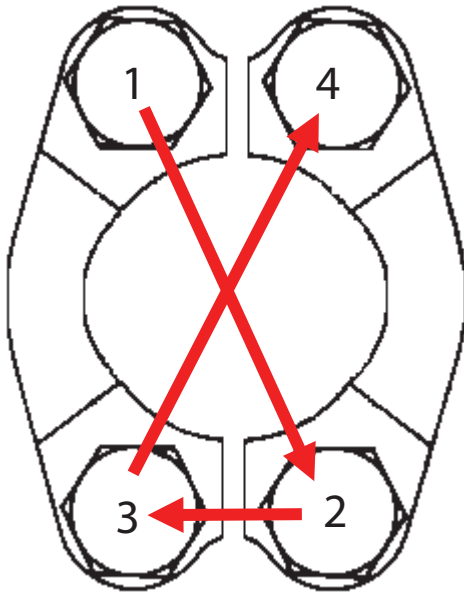


Figure 32

## 9.2 Bolt Torque Specifications

When tightening bolts, review and refer to the following tables as needed.

Table 6 - TORQUE VALUES FOR BOLTS USED WITH STANDARD HEX AND FLANGE NUTS (1 of 2)

Table 6 - TORQUE VALUES FOR BOLTS USED WITH STANDARD HEX AND FLANGE NUTS (1 of 2)										
Nominal Diameter (in)	Threads Per Inch	SAE J429 GRADE 5			SAE J429 GRADE 8			SAE J429 GRADE 9		
		ROUGH	PLATED	LUBED	ROUGH	PLATED	LUBED	ROUGH	PLATED	LUBED
UNIFIED COARSE THREAD SERIES (UNC)										
1/4	20	8	7	6	12	11	9	14	13	11
5/16	18	17	15	13	25	23	19	29	26	22
3/8	16	31	28	23	44	40	33	51	46	38
7/16	14	49	44	37	70	63	53	82	74	62
1/2	13	75	68	56	106	95	80	125	113	94
9/16	12	114	103	86	169	152	127	196	176	147
5/8	11	150	135	113	212	191	159	248	223	186
3/4	10	267	240	200	376	338	282	441	397	331
7/8	9	429	386	322	606	545	455	710	639	533
1	8	644	580	483	909	818	682	1065	959	799
1-1/8	7	872	785	654	1430	1287	1073	1672	1505	1254
1 1/4	7	1121	1009	841	1817	1635	1363	2130	1917	1598
1-1/2	6	1950	1755	1463	3162	2846	2372	3706	3335	2780
FINE THREAD SERIES (UNF)										
1/4	28	10	9	8	14	13	11	16	14	12
5/16	24	19	17	14	27	24	20	32	29	24
3/8	24	35	32	26	49	44	37	58	52	44
7/16	20	55	50	41	78	70	59	91	82	68
1/2	20	85	77	64	120	108	90	141	127	106
9/16	18	124	112	93	184	166	138	221	199	166
5/8	18	170	153	128	240	216	180	281	253	211
3/4	16	297	267	223	420	378	315	492	443	369
7/8	14	474	427	356	669	602	502	784	706	588
1	14	722	650	542	1020	918	765	1195	1076	896
1-1/8	12	950	855	713	1559	1403	1169	1876	1688	1407
1 1/4	12	1241	1117	931	2012	1811	1509	2358	2122	1769
1-1/2	12	2194	1975	1646	3557	3201	2668	4169	3752	3127

Table 7 - TORQUE VALUES FOR BOLTS USED WITH LOCK NUTS (2 of 2)

Table 7 - TORQUE VALUES FOR BOLTS USED WITH LOCK NUTS (2 of 2)									
Nominal Diameter (in)	Threads Per Inch	STAINLESS STL 304, 18-8		GR C (HEX LOCK NUT GR8)			GR G (HEX FLANGE LOCK NUT GR8)		
		ROUGH	LUBED	ROUGH	PLATED	LUBED	ROUGH	PLATED	LUBED
UNIFIED COARSE THREAD SERIES (UNC)									
1/4	20	6	5	10	9	8	10	9	8
5/16	18	11	9	19	17	14	21	18	15
3/8	16	20	17	33	29	24	37	33	28
7/16	14	31	27	52	47	39	59	53	44
1/2	13	43	37	80	72	60	91	81	68
9/16	12	56	48	115	104	86	131	117	98
5/8	11	92	78	159	143	119	180	162	135
3/4	10	127	108	283	254	212	320	288	240
7/8	9	194	165	455	409	341			
1	8	286	243	682	613	511			
1-1/8	7			966	869	725			
1-1/4	7			1363	1227	1022			
1-1/2	6								
Fine Thread Series (UNF)									
1/4	28	8	7	11	9	8	12	10	9
5/16	24	12	10	21	18	15	23	21	17
3/8	24	22	18	37	33	28	42	38	32
7/16	20	33	28	59	53	44	66	59	50
1/2	20	45	38	90	81	68	102	92	77
9/16	18	62	53	129	116	96	146	131	109
5/8	18	103	88	180	162	135	204	184	153
3/4	16	124	105	320	288	240	357	321	268
7/8	14	193	164	502	451	376			
1	14	259	220	765	689	574			
1-1/8	12			1083	975	812			
1-1/4	12			1509	1358	1132			
1-1/2	12								

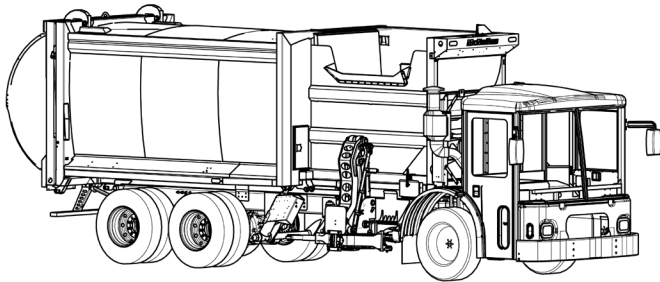
Table 8 - STANDARD TORQUE VALUES FOR METRIC FASTENERS

Table 8 - STANDARD TORQUE VALUES FOR METRIC FASTENERS										
Nominal Diameter (mm)	Pitch	CLASS 4.6			CLASS 8.8			CLASS 10.9		
		ROUGH	PLATED	LUBED	ROUGH	PLATED	LUBED	ROUGH	PLATED	LUBED
COARSE THREAD SERIES										
6	1	3	3	2	8	7	6	11	10	8
7	1	5	5	4	13	12	10	19	17	14
8	1.25	7	7	5	19	17	14	27	24	20
10	1.5	14	13	11	37	33	28	53	48	40
12	1.75	25	23	19	65	58	49	93	84	70
14	2	40	36	30	104	93	78	148	134	111
16	2	62	56	47	161	145	121	230	207	173
18	2.5	86	78	65	222	200	167	318	286	239
20	2.5	122	110	91	314	283	236	449	404	337
22	2.5	166	149	125	428	385	321	613	551	460
24	3	211	190	158	543	488	407	777	699	582
27	3	309	278	232	796	716	597	1139	1025	854
30	3.5	419	377	314	1079	971	809	1544	1389	1158
33	3.5	570	513	427	1468	1321	1101	2101	1891	1576
36	4	732	659	549	1886	1697	1415	2699	2429	2024
FINE THREAD SERIES										
6	0.75	3	3	2	8	8	6	12	11	9
7	0.75	5	5	4	14	13	11	20	18	15
8	1	8	7	6	20	18	15	29	26	22
10	1.25	16	14	12	41	36	30	58	52	43
12	1.25	27	25	21	71	64	53	101	91	76
14	1.5	44	39	33	113	102	85	162	146	121
16	1.5	68	61	51	175	158	131	251	226	188
18	1.5	94	85	70	242	218	182	347	312	260
20	1.5	133	120	100	342	308	257	490	441	367
22	1.5	181	163	136	467	420	350	668	601	501
24	2	230	207	172	592	532	444	846	762	635
27	2	337	303	252	867	781	650	1241	1117	931
30	2	456	411	342	1176	1058	882	1683	1514	1262
33	2	621	559	466	1600	1440	1200	2290	2061	1718
36	2	798	718	598	2056	1850	1542	2942	2648	2207

Notes:

1. All values listed in foot pounds (ft.-lbs.).
2. "Rough" refers to dry fasteners with unfinished steel or black oxide coated steel.
3. "Plated" refers to dry steel fasteners plated with yellow zinc, clear zinc, or cadmium wax as well as any fastener using a thread sealant.
4. "Lubed" refers to any fastener lubricated with oil or anti-seize.





# Troubleshooting

## Table of Contents

1.0 TROUBLESHOOTING CHART ..... 4-3

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### 1.0 Troubleshooting Chart

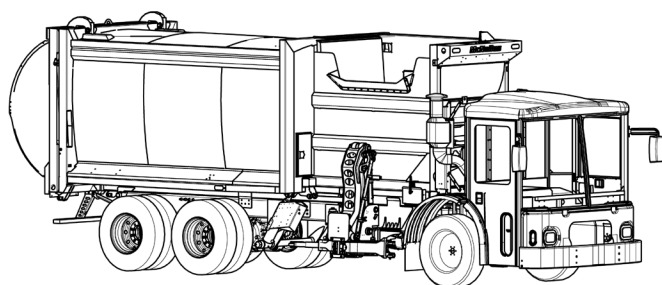
When a problem or malfunction occurs, follow these steps. The sequence below will help isolate the problem and often permit a quick repair. If further assistance is required, refer to the applicable section of the manual or contact McNeilus Parts and Service listed in the Foreword of this manual.

#### NOTE

**Isolate the problem before taking any remedial actions.**

1. Unless further damage will occur, repeat the steps that caused the problem. Refer to the Operation section of this manual to be sure that the correct operating procedures have been followed. Often a simple step in the standard operating procedure has been forgotten.
2. Refer to the troubleshooting chart. It is designed to help you troubleshoot problems at your location, and is organized in a logical sequence. Look under the appropriate equipment section, and for the specific problem within the chart.
3. Perform the checkout procedure and remedial actions listed within the chart to isolate the problem.
4. If your particular problem is not listed, or the remedial actions provided do not resolve the problem, we suggest that you take the vehicle to a service shop, refer to the appropriate service manual, or contact McNeilus Truck and Manufacturing, Inc. for service assistance.
5. If you have questions or need help, please contact McNeilus Parts and Service listed in the Foreword of this manual.

Problem	Probable Cause	Action
All functions not working	<ol style="list-style-type: none"> <li>1. BATTERY DISCONNECT switch is off.</li> <li>2. IGNITION switch is off.</li> <li>3. One or more E-STOP buttons is down.</li> <li>4. PUMP switch is off.</li> <li>5. Side door is open.</li> <li>6. Cleanout door is open.</li> <li>7. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn BATTERY DISCONNECT switch on.</li> <li>2. Turn IGNITION switch on.</li> <li>3. Release all E-STOP buttons.</li> <li>4. Turn PUMP switch on.</li> <li>5. Close side door.</li> <li>6. Close cleanout door.</li> <li>7. Requires shop service and repair.</li> </ol>
Joystick functions not working	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. ARM ACTIVE switch not activated.</li> <li>3. OPERATOR PRESENCE switch not pressed.</li> <li>4. Side door is open.</li> <li>5. Cleanout door is open.</li> <li>6. Air below 90 PSI.</li> <li>7. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 900 rpm.</li> <li>2. Activate ARM ACTIVE switch.</li> <li>3. Press OPERATOR PRESENCE switch.</li> <li>4. Close side door.</li> <li>5. Close cleanout door.</li> <li>6. Check air gauge in cab. PSI must be at 90 or above.</li> <li>7. Requires shop service and repair.</li> </ol>
Automatic Pack and Sweep functions not working	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. Tailgate is open.</li> <li>3. Side door is open.</li> <li>4. Cleanout door is open.</li> <li>5. Check PACK AND SWEEP PROXIMITY switches for proper operation.</li> <li>6. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 1700 rpm.</li> <li>2. Close tailgate.</li> <li>3. Close side door.</li> <li>4. Close cleanout door.</li> <li>5. Requires shop service and repair.</li> <li>6. Requires shop service and repair.</li> </ol>
Packing Panel stalls in any position other than HOME	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. Side door open.</li> <li>3. Cleanout door is open.</li> <li>4. Material preventing Packing Panel from returning to HOME position or completing auto pack cycle.</li> <li>5. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 1700 rpm.</li> <li>2. Close side door.</li> <li>3. Close cleanout door.</li> <li>4. Remove obstruction and manually retract Packing Panel.</li> <li>5. Requires shop service and repair.</li> </ol>
Manual Pack and Sweep functions not working	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. Side door open.</li> <li>3. Cleanout door is open.</li> <li>4. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 1700 rpm.</li> <li>2. Close side door.</li> <li>3. Close cleanout door.</li> <li>4. Requires shop service and repair</li> </ol>
Tailgate functions not working	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. ACTIVATE switch not pressed.</li> <li>3. Cleanout door is open.</li> <li>4. Side door is open.</li> <li>5. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 1700 rpm.</li> <li>2. Press ACTIVATE switch while pressing TAILGATE Switch.</li> <li>3. Close cleanout door.</li> <li>4. Close side door.</li> <li>5. Requires shop service and repair.</li> </ol>
Grabber assembly will not dump	<ol style="list-style-type: none"> <li>1. Engine rpm too high.</li> <li>2. OPERATOR PRESENCE switch not pressed.</li> <li>3. Hopper cover is closed.</li> <li>4. Air below 90 PSI.</li> <li>5. System problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce engine speed to below 900 rpm.</li> <li>2. Press OPERATOR PRESENCE switch.</li> <li>3. Open hopper cover.</li> <li>4. Check air gauge in cab. PSI must be at 90 or above.</li> <li>5. Requires shop service and repair.</li> </ol>



# Hydraulic Overspeed Control

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## 1.0 General Information

McNeilus uses the Hydraulic Overspeed Control (HOC) system.

During normal operation, the pump switch (Figure 1, Item 1) is in the ON position, and the normally open (N.O.) valve (Figure 1, Item 2) is energized blocking pilot pressure oil to the inlet unloader valve (Figure 1, Item 3). The inlet unloader valve spool will remain in the WORK position providing oil flow to all hydraulic functions.

The HOC system is used for two reasons. First, the HOC system provides the operator the ability to disable all hydraulic functions.

When the pump switch (Figure 2, Item 1) is in the OFF position, an alternative path for the oil flow to the reservoir is introduced. In this condition, the normally open (N.O.) valve (Figure 2, Item 2) is de-energized diverting pilot pressure oil (Figure 2, Item 3) from the outlet side of the pump (Figure 2, Item 4) to shift the inlet unloader valve (Figure 2, Item 5). The inlet unloader valve spool will shift from the WORK position to the UNLOADED position, bypassing all hydraulic functions.

Second, the HOC system ensures a continuous supply of oil is maintained to the fixed displacement hydraulic pump at higher engine revolutions per minute (rpm) for overspeed control.

The flow control spool (Figure 3, Item 1) will shift between 1400-1600 engine rpm. When the flow control spool shifts, it directs oil flow through two ports.

The smaller port (Figure 3, Item 2) provides pilot pressure through the sense line to shift the inlet unloader valve (Figure 3, Item 3) from the WORK position to the UNLOADED position. This will direct all hydraulic oil to the reservoir to maintain adequate oil supply for the suction line of the pump.

The larger port (Figure 3, Item 4) regenerates up to 15 gallons per minute (gpm) to the suction side of the pump (Figure 3, Item 5). This additional oil along with the normal oil supply through the suction line will provide adequate oil delivery to meet the pump's oil requirement for the higher revolutions per minute.

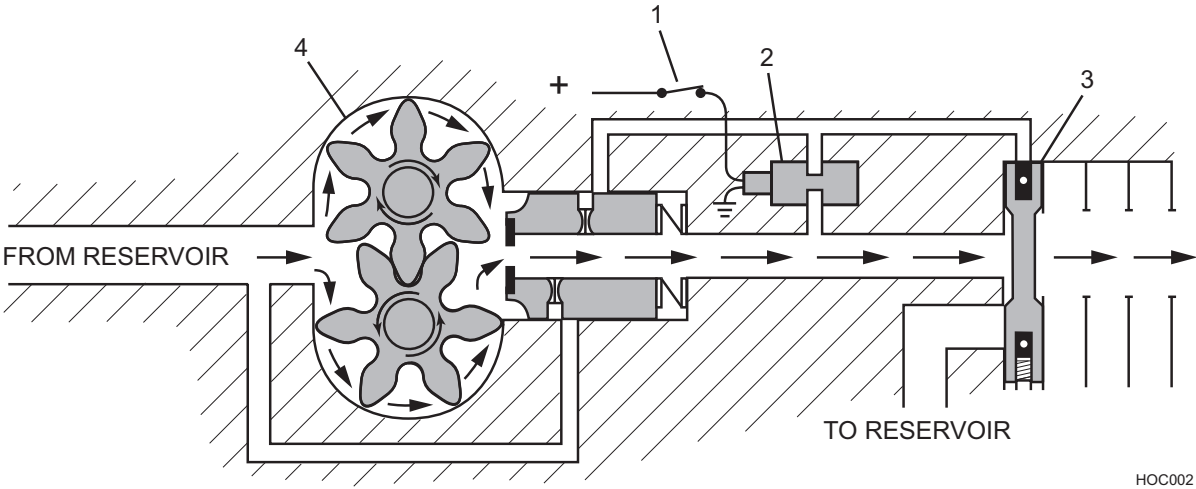


Figure 1

HOC002

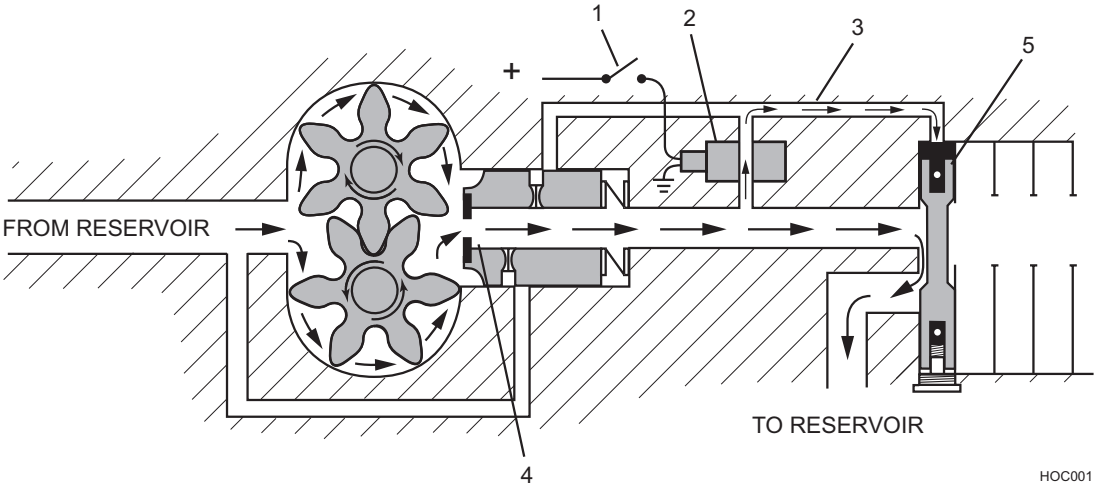


Figure 2

HOC001

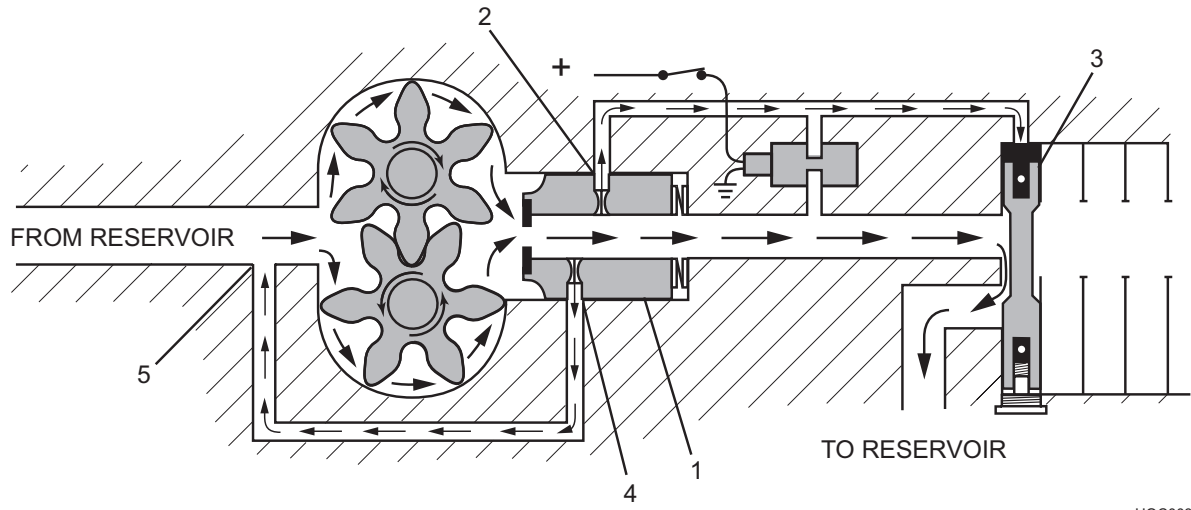


Figure 3

HOC003



## 2.0 Pump

The HOC system uses a fixed displacement gear pump. The oil flow from a fixed displacement pump will increase as the engine revolutions per minute increase.

The pump is either direct drive or PTO driven. The pump is either front mounted (Figure 4, Item 1) or transmission mounted (Figure 5, Item 1).

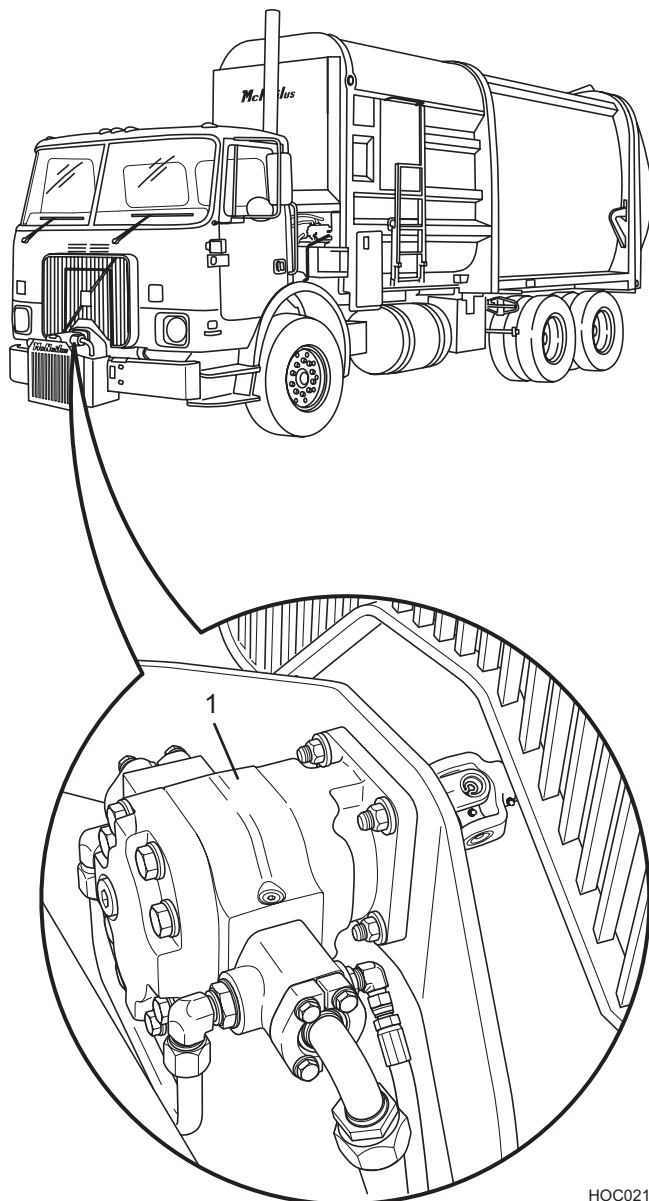


Figure 4

HOC021

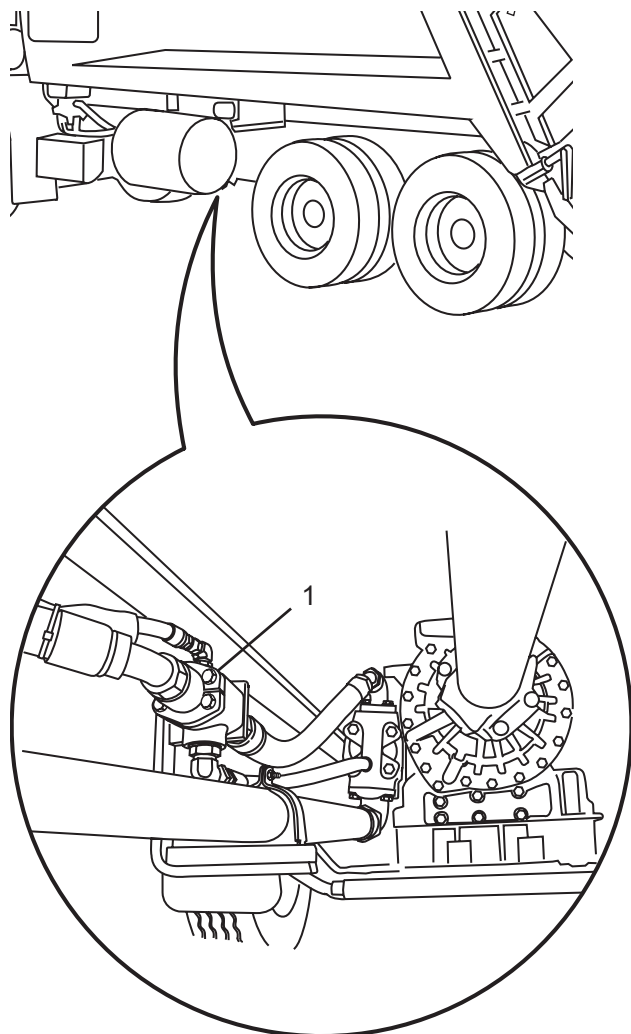


Figure 5

Some models use a tandem pump (Figure 6, Item 1), which is two individual pumps driven by a common drive.

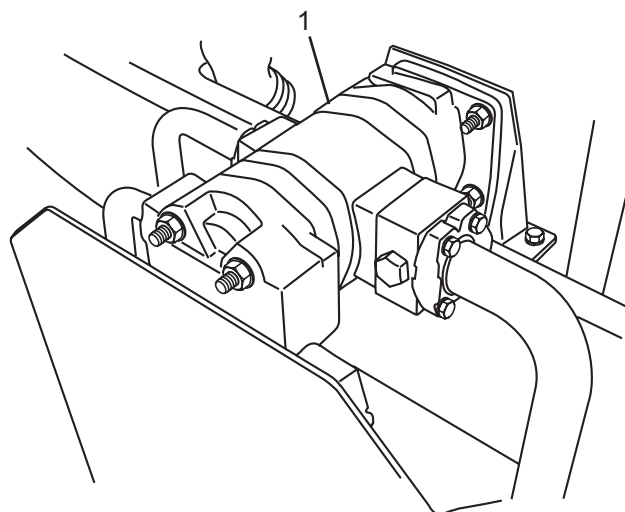


Figure 6

## 3.0 Inlet Unloader Valve

The inlet unloader valve controls the direction of oil flow within the system. The inlet unloader valve is the first valve of the valve stack in the pressure line directly after the pump (Figure 7, Item 1).

The inlet unloader valve consists of a large spool (Figure 8, Item 1), a spring (Figure 8, Item 2), and a shorter spool (Figure 8, Item 3).



*The large spool is "lapped fit" to the housing. If damaged, the large spool valve and housing must be replaced as an assembly.*

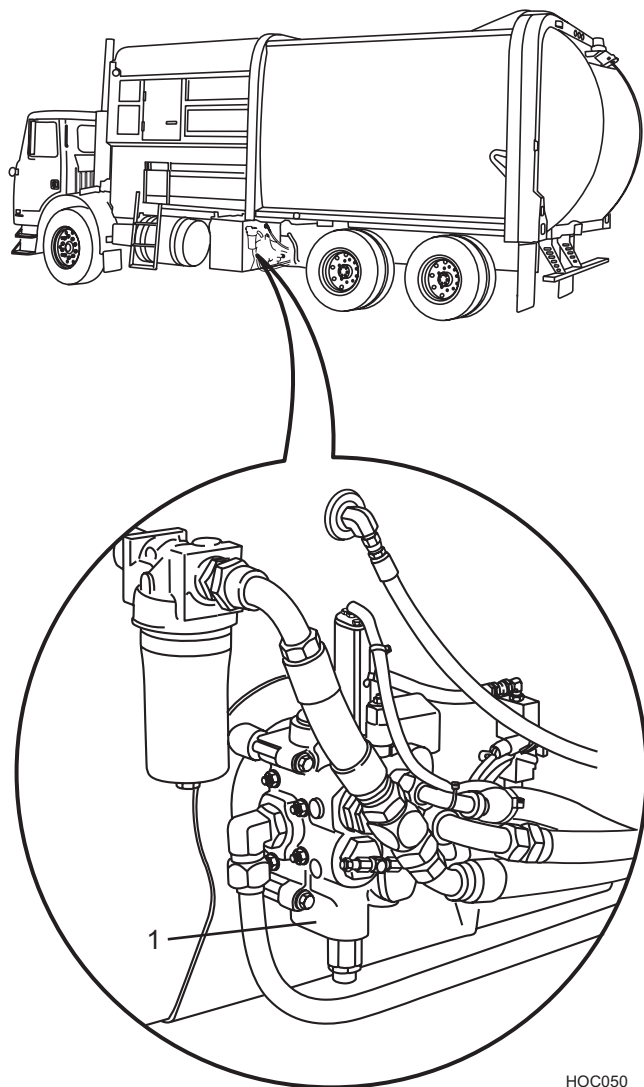


Figure 7

HOC050

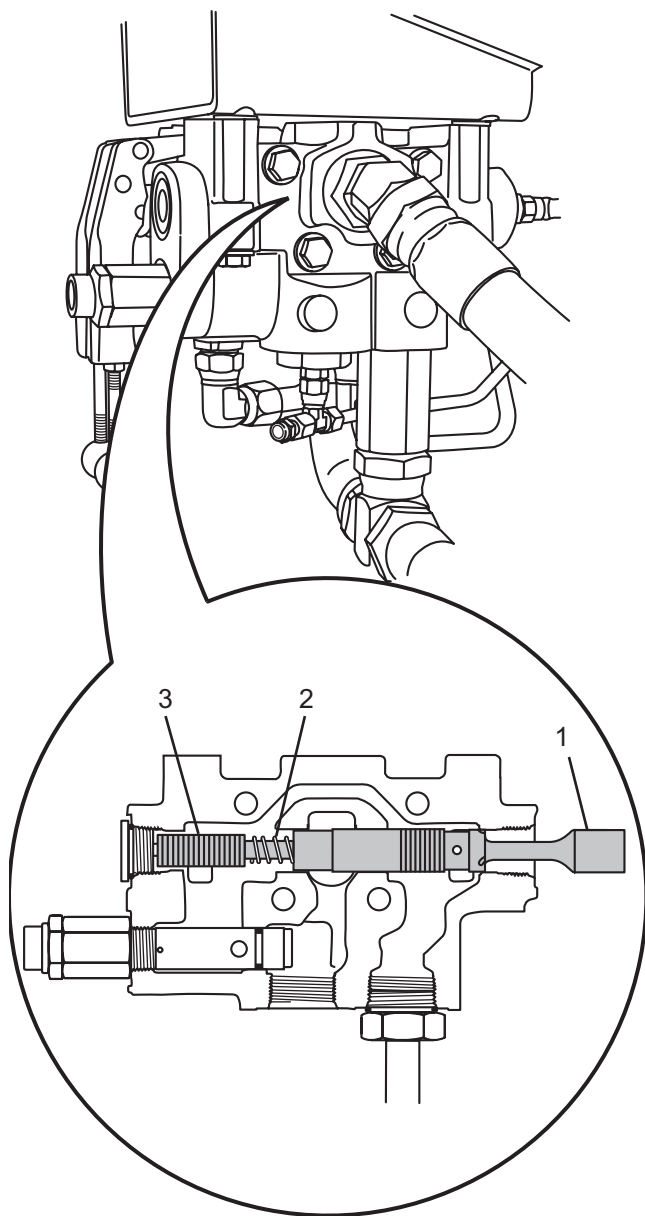
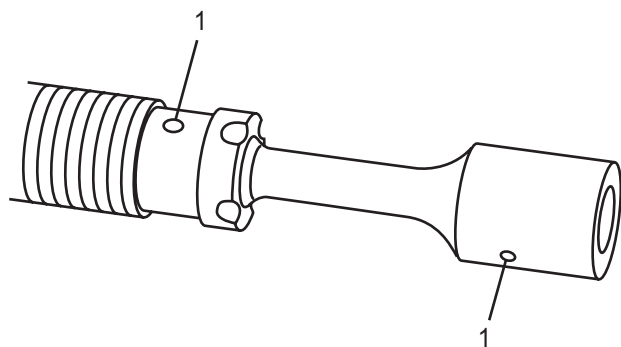


Figure 8

HOC023

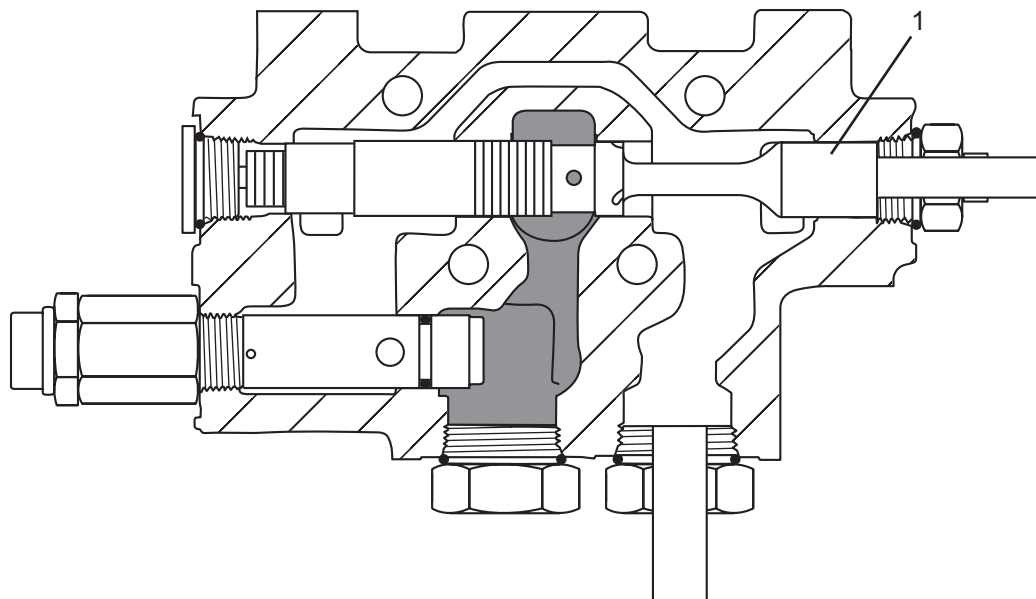
The large spool contains two orifices (Figure 9, Item 1) to provide "Bleed-Off" of pilot oil pressure.



HOC061

Figure 9

The inlet unloader valve is normally in one of two positions: the WORK position or the UNLOADED position. The large spool (Figure 10, Item 1) is held in the WORK position by the spring when no hydraulic signal is present from the flow control of the N.O. valve.



HOC051

Figure 10

When a hydraulic signal (Figure 11, Item 1) is received at the inlet unloader valve, the large spool (Figure 11, Item 2) shifts from the WORK position to the UNLOADED position. The UNLOADED position allows oil flow from the pump to flow directly from the front side of the inlet unloader valve, through the return line filter, and to the reservoir rather than into and through the entire hydraulic valve stack and back to the reservoir.

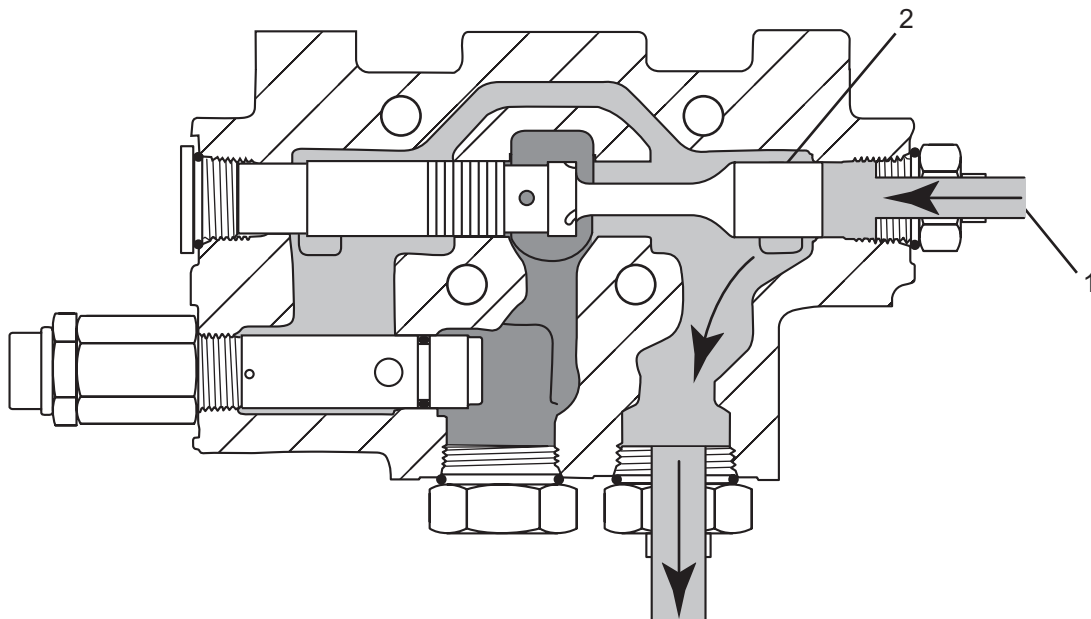


Figure 11

HOC052

## 4.0 Normally Open (N.O.) Valve

The normally open (N.O.) valve is used to shift the inlet unloader valve.

The N.O. valve can either be an individual valve (Figure 12, Item 1) or a component of the combo block (Figure 13, Item 1).

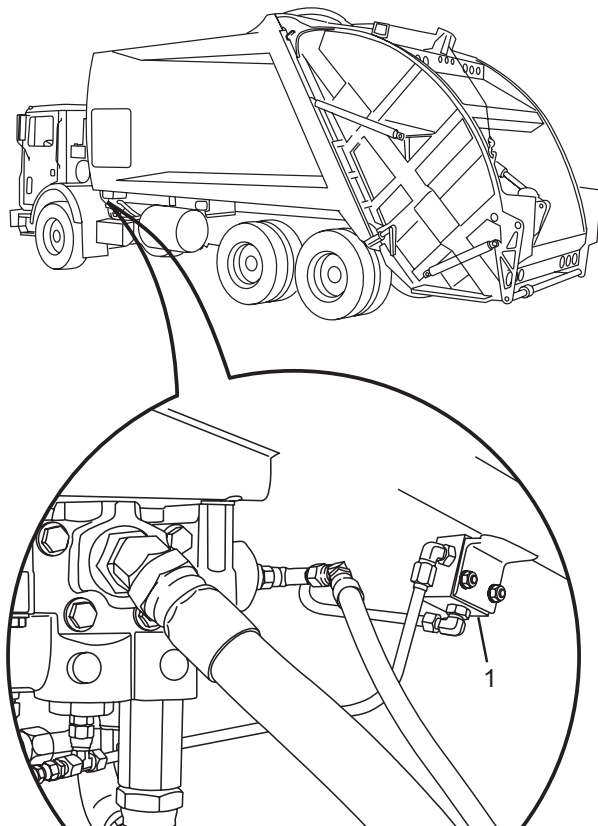


Figure 12

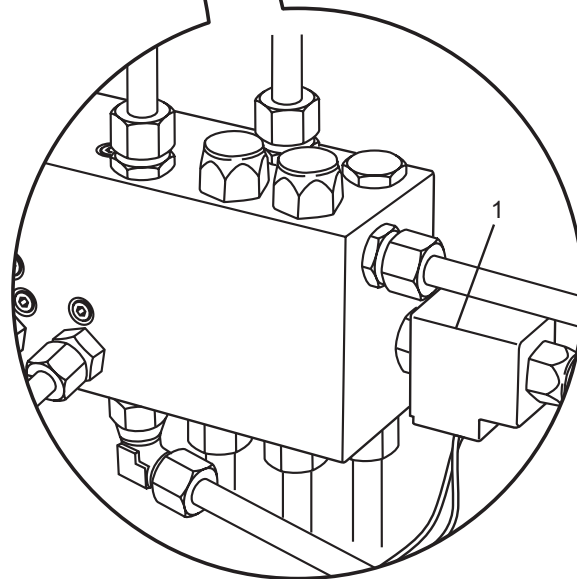
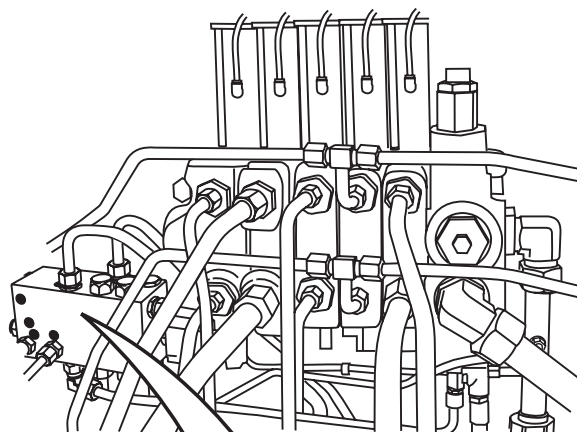


Figure 13

HOC027

# Hydraulic Overspeed Control

The N.O. valve is activated by a pump switch or the E-Stop button. Some refuse vehicles have additional options to activate the N.O. valve, such as depressing the brake pedal or activating a pump enable switch.

During normal operation, the N.O. valve is energized blocking pilot pressure oil to the inlet unloader valve. The inlet unloader valve spool will remain in the WORK position providing oil flow to all hydraulic functions.

The N.O. valve is a block with a normally open cartridge (Figure 14, Item 1) activated by a 12-volt solenoid are common between a single installation and a combo-block installation.

Normally open means oil can flow through the cartridge if the 12-volt solenoid (Figure 14, Item 2), mounted on top of the cartridge, is not energized. Oil flowing through the cartridge is directed to the sense line port of the inlet unloader valve moving it to the UNLOADED position.

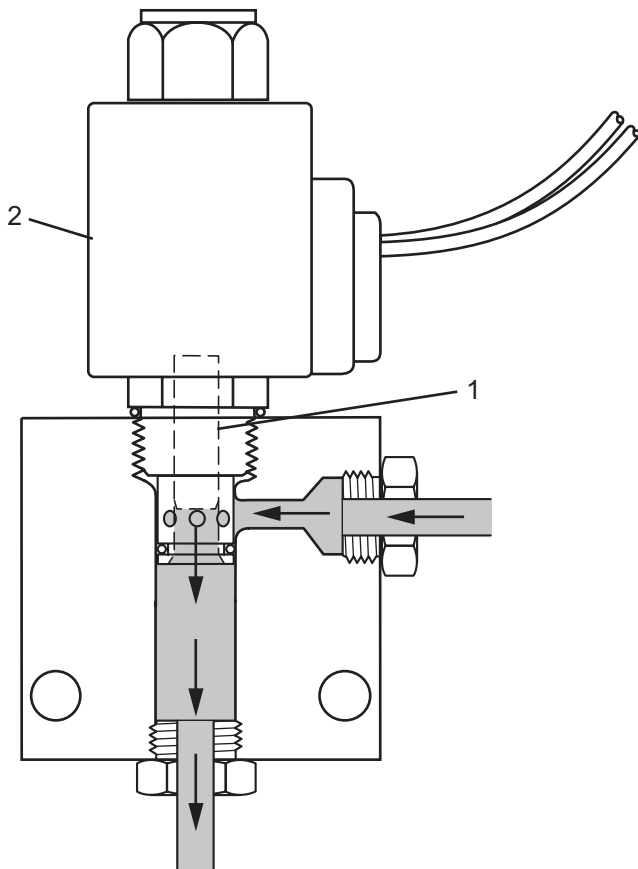


Figure 14

When the pump switch is turned ON, the solenoid is energized and the cartridge (Figure 15, Item 1) changes to the closed position and oil flow can no longer pass through it. The inlet unloader valve then is in the WORK position and the hydraulic functions are operable and ready for work.

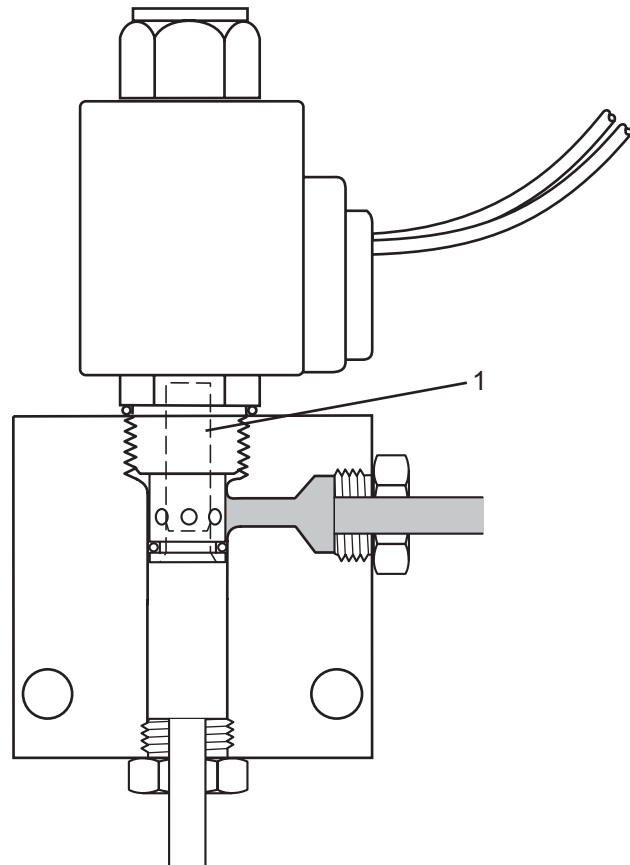


Figure 15

## 5.0 Flow Control

The flow control determines the amount of working oil that can travel through the hydraulic system.

The flow control can be mounted on the output side of the pump (Figure 16, Item 1), or in the pressure line (Figure 17, Item 1) between the pump and inlet unloader valve.

Models with small pumps do not require the use of a flow control. The smaller pump receives an adequate oil supply from the reservoir at high RPM.

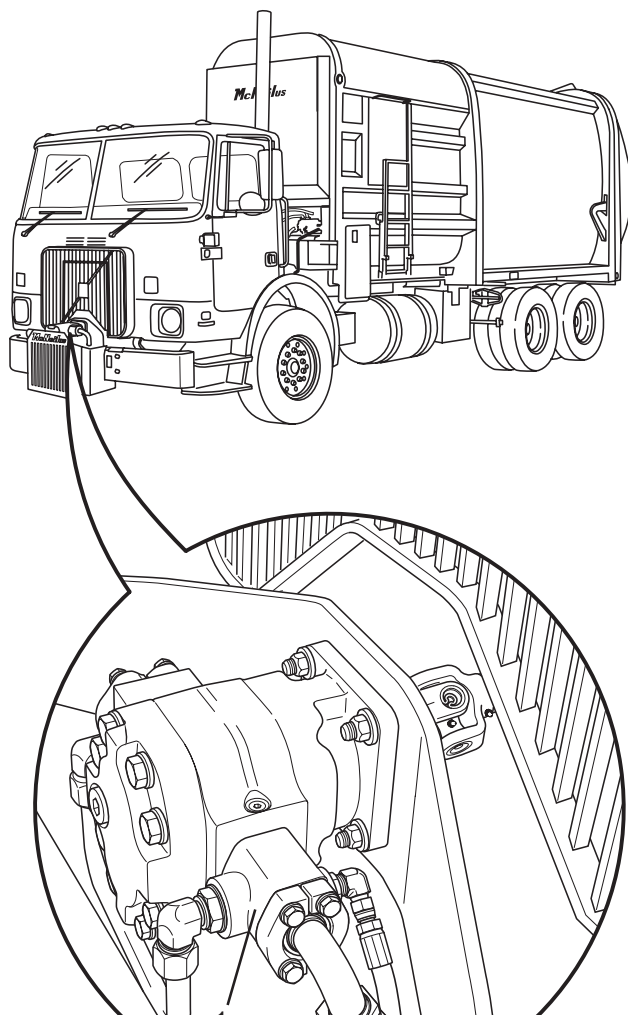


Figure 16

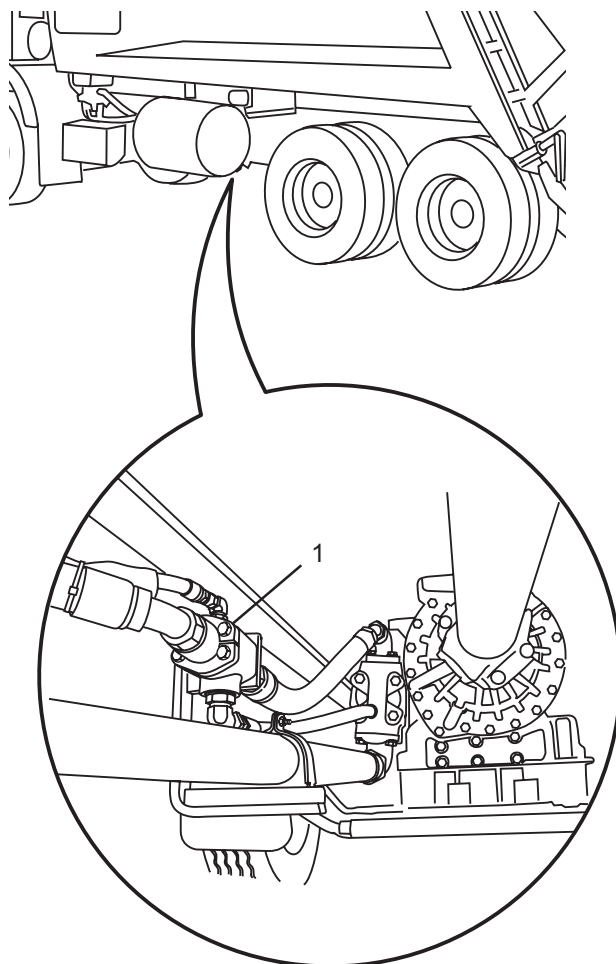


Figure 17

H00030

# Hydraulic Overspeed Control

The flow control consists of a spool (Figure 18, Item 1) with an orifice (Figure 18, Item 2), and a spring (Figure 18, Item 3). The orifice size is different between pumps. Orifice size is 0.535 in.

All oil flow from the pressure side of the pump is directed through the orifice in the spool (Figure 19, Item 1) to the inlet unloader valve when the pump is operating below the flow control setting.

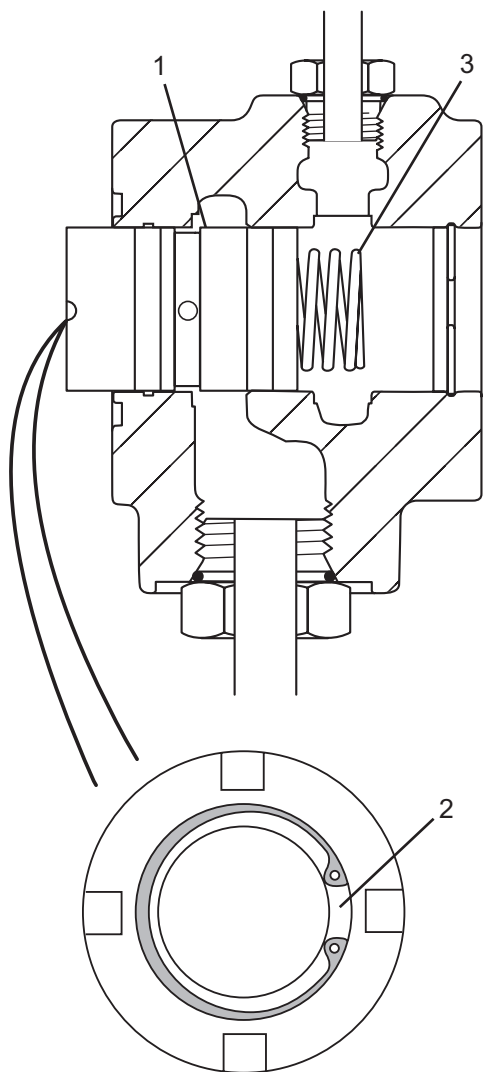


Figure 18

HOC046

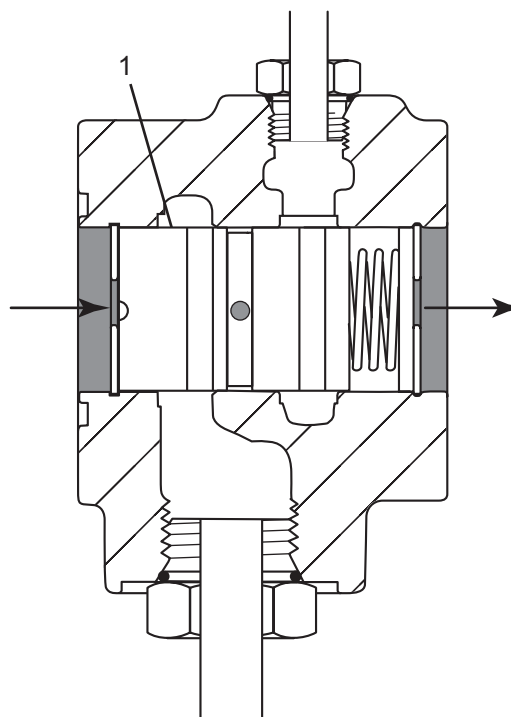


Figure 19

HOC055



The oil flow from the pressure side of the pump is directed through the orifice. Oil flow will force the spool (Figure 20, Item 1) to shift against its spring (Figure 20, Item 2), in the direction of the flow. This will happen when the pump flow reaches 2-3 gpm over the predetermined working flow. When the flow decreases, the spring will become stronger than the flow forces and the spool will return to its normal position.

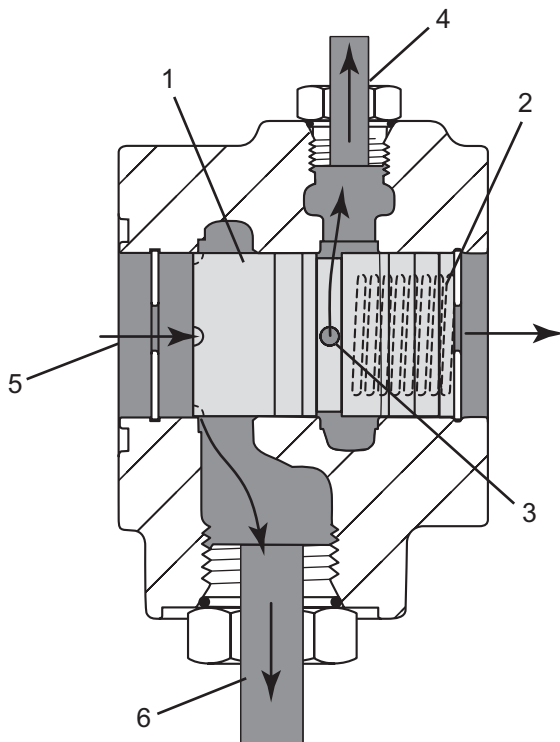


Figure 20

HOC056

The flow control has two ports that divert oil from it when the spool shifts between 1400-1600 engine rpm.

An orifice (Figure 20, Item 3) in the spool provides the oil supply for the smaller port (Figure 20, Item 4). The smaller port directs pilot pressure through the sense line to shift the inlet unloader valve from the WORK position to the UNLOADED position. This will direct all hydraulic oil to the reservoir to maintain adequate oil supply for the suction line of the pump.

The inlet side of the flow control (Figure 20, Item 5) provides the oil supply for the larger port (Figure 20, Item 6). The larger port regenerates up to 15 gpm to the suction side of the pump. This additional oil along with the normal oil supply through the suction line will provide adequate oil delivery to meet the pump's oil requirement for the higher revolutions per minute.

The regeneration line (Figure 21, Item 1) can be connected to a spacer block (Figure 21, Item 2) located between the suction line (Figure 21, Item 3) and the pump.

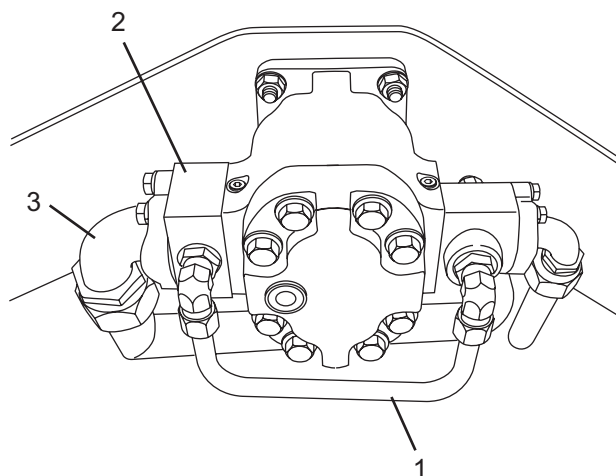


Figure 21

HOC053

The regeneration line (Figure 22, Item 1) can be installed into a port located in the end cover (Figure 22, Item 2) on the suction side (Figure 22, Item 3) of the pump.

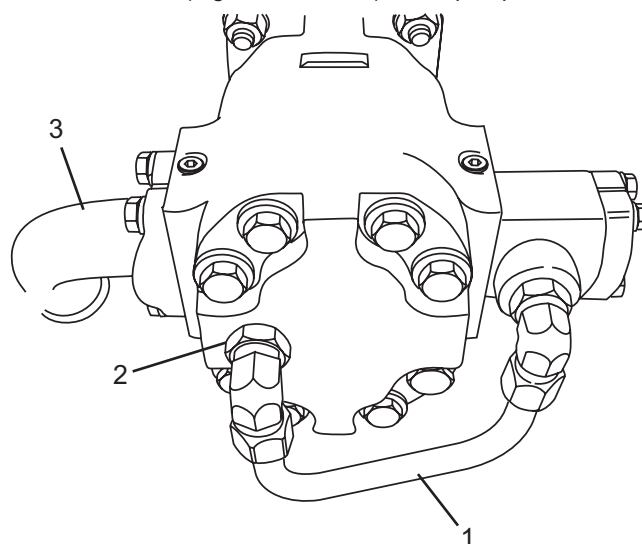


Figure 22

HOC054

## 6.0 HOC vs. Dry Valve

The use of the HOC system is new for the refuse industry. Other manufacturers use the dry valve system. The dry valve system is different from the HOC system in that it turns off all oil flow to the pump except for 2-3 gpm used for pump lubrication. When a dry valve is turned ON or OFF, a growling sound is made in the pump. This noise is cavitation causing damage to the pump's wear plates. Cavitation is the introduction of air into the hydraulic system due to lack of adequate oil supply. This condition will shorten the life of the pump.

The HOC system is sensitive to pump flow. The flow control is used to sense pump flow. No electrical interfacing to the truck's alternator, engine, or transmission is required.

The HOC system offers many benefits:

- No electrical modules are used and no interfacing to the truck's electrical system is required.
- Cavitation of the pump is eliminated. The HOC system has a net inlet flow from the reservoir to the pump equal to the HOC cut-off flow rather than the maximum pump output. It is possible to retrofit the HOC system using the existing inlet line.
- Contamination control is improved by continuously flushing the oil through the return filters.
- Warm up is faster during the winter due to continuous oil circulation.
- The system is not affected by pump wear. As the pump's volumetric efficiency drops, the cutout speed increases because the HOC system senses flow.

## 6.1 Description of Operation

### 6.1.1 Condition 1 - Morning Warm Up in Yard

- Oil flow within working range
- Flow control not shifted (Figure 23, Item 1)
- Pump switch OFF (Figure 23, Item 2)
- N.O. valve in OPEN position (Figure 23, Item 3)
- Inlet unloader valve in UNLOADED position (Figure 23, Item 4)

When warming up the truck in the morning, the pump switch is a manual way of redirecting oil flow, bypassing the spool valve assembly (Figure 23, Item 5). You can direct oil directly to the reservoir by turning the pump switch OFF, opening the N.O. valve.

When the N.O. valve is open, pilot pressure oil (Figure 23, Item 6) moves the inlet unloader valve to the UNLOADED position, bypassing the spool valve assembly, diverting all oil directly to the reservoir.

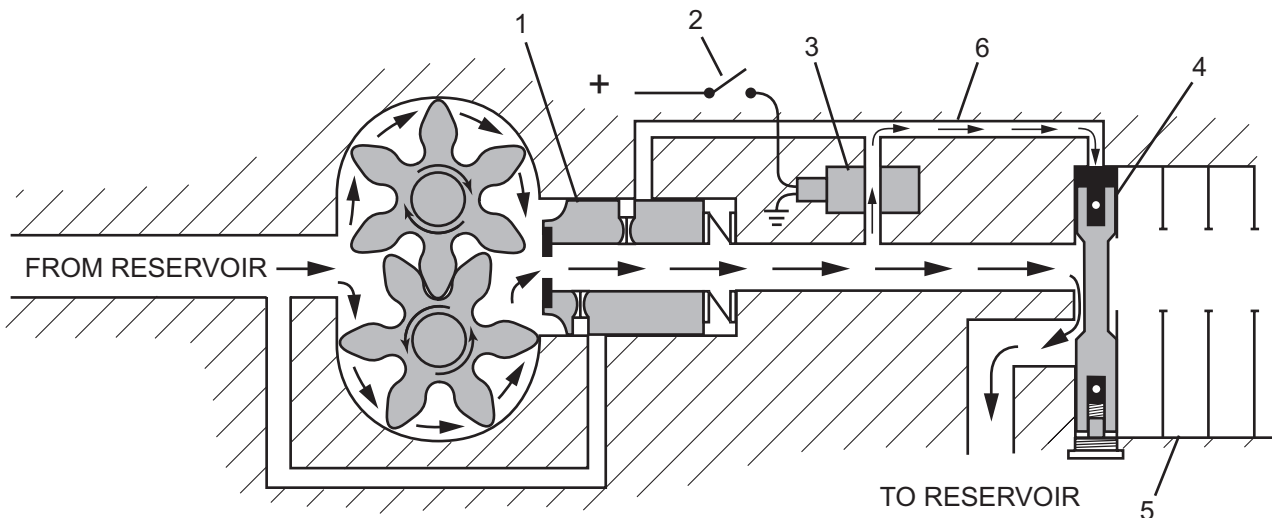


Figure 23

HOC035

## 6.1.2 Condition 2 - Driving Truck to Route. Pump Flow Exceeds Flow Control Setting

- Oil flow exceeds working range
- Flow control shifts (Figure 24, Item 1)
- Pump switch OFF (Figure 24, Item 2)
- N.O. valve in OPEN position (Figure 24, Item 3)
- Inlet unloader valve in UNLOADED position (Figure 24, Item 4)

While driving the truck when the pump flow exceeds the flow control setting, the flow control will shift directing up to 15 gpm of additional oil to the suction side of the pump. This normally happens at an engine rpm of 1400-1600. The additional oil (Figure 24, Item 5) along with the normal oil supply through the suction line will provide adequate oil delivery to the pump preventing cavitation.

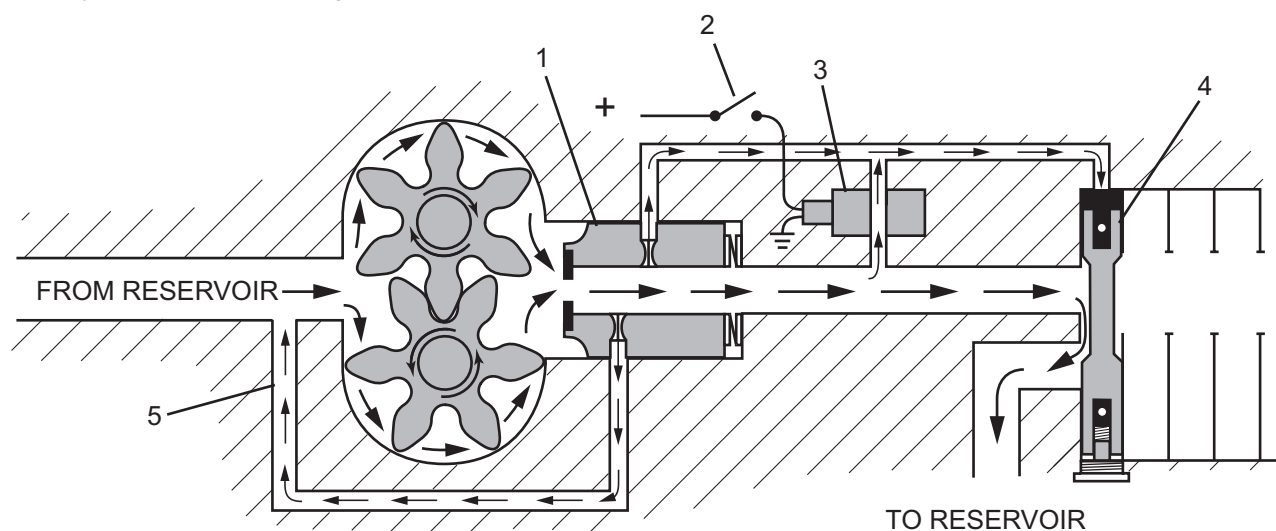


Figure 24

HOC004

## 6.1.3 Condition 3 - Normal Packer Operation on Route

- Oil flow within working range
- Flow control not shifted (Figure 25, Item 1)
- Pump switch ON (Figure 25, Item 2)
- N.O. valve in CLOSED position (Figure 25, Item 3)
- Inlet unloader valve in WORK position (Figure 25, Item 4)

While operating the refuse vehicle on the route, the system will operate normally allowing the vehicle to work as long as the engine rpm remains low enough to keep the pump's flow below the flow control setting.

Oil from the pressure side of the pump will pass through the flow control to the inlet unloader valve allowing operation of the spool valve assembly (Figure 25, Item 5). Oil from the spool valve assembly then returns back to the reservoir.

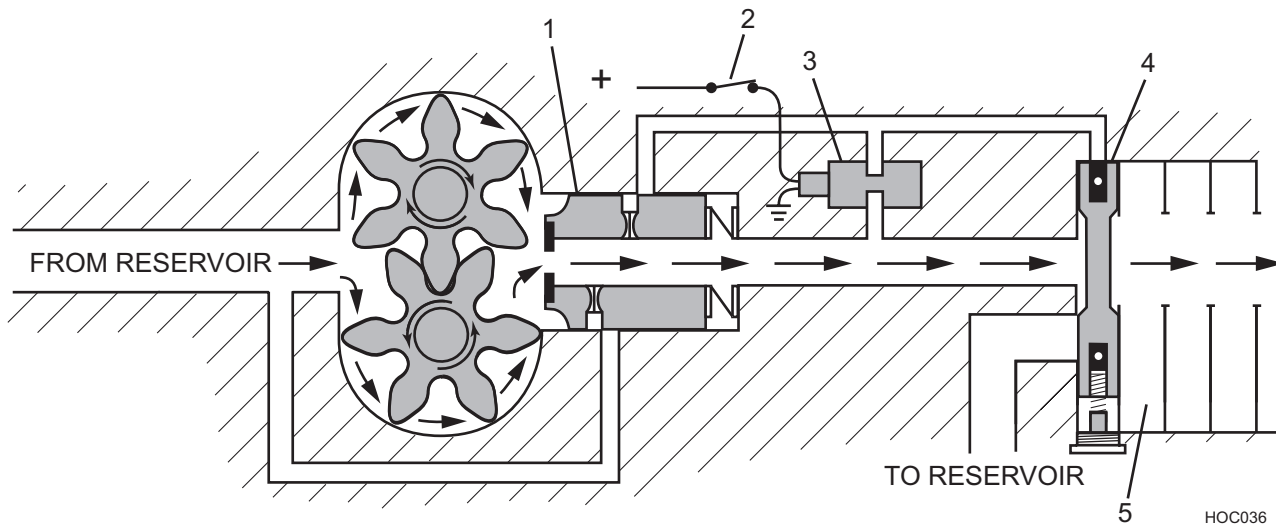


Figure 25

HOC036

## 6.1.4 Condition 4 - Packer Operation on Route. Pump flow exceeds flow control setting

- Oil flow exceeds working range
- Flow control shifts (Figure 26, Item 1)
- Pump switch ON (Figure 26, Item 2)
- N.O. valve in CLOSED position (Figure 26, Item 3)
- Inlet unloader valve in UNLOADED position (Figure 26, Item 4)

While operating the refuse vehicle on the route, the engine speed can increase causing the flow control to exceed the flow control setting causing the flow control to shift. This normally occurs between 1400-1600 rpm. As the pump flow output increases relative with engine revolutions per minute, the orifice in the flow control spool cannot handle the increase of flow. Pressure against the spool will cause the flow control spool to shift directing the oil flow through two ports.

The smaller port (Figure 26, Item 5) will shift the inlet unloader valve from the WORK position to the UNLOADER position. This will direct all hydraulic oil to the reservoir, bypassing the spool valve assembly, to maintain adequate oil supply for the suction line of the pump.

The larger port (Figure 26, Item 6) will regenerate up to 15 gpm to the suction side of the pump. This additional oil along with the normal oil supply through the suction line will provide adequate oil delivery to meet the pump's oil requirement for the higher revolutions per minute, protecting it from cavitation damage.

The truck's hydraulic functions will remain inoperable at all speeds above the flow control setting. To restore the hydraulic functions, the operator must lower the engine speed approximately 300 to 400 rpm below the flow control setting.

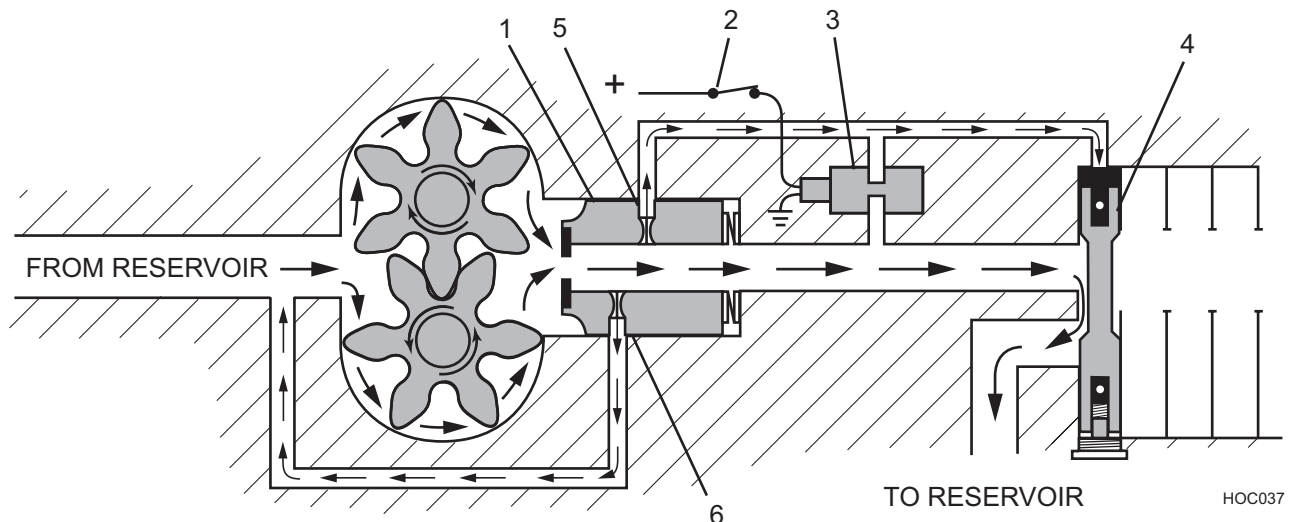


Figure 26

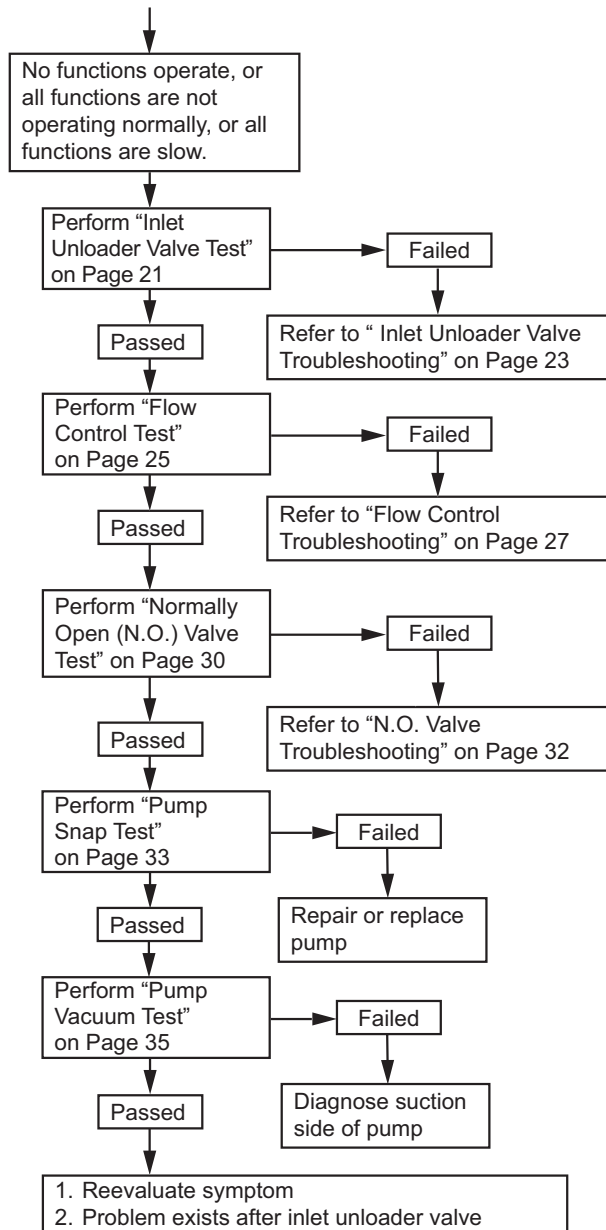
HOC037

## 7.0 HOC Troubleshooting

If all the refuse vehicle's hydraulic functions are not operating normally or are slow, start your testing with the "Pump Vacuum Test."

If no hydraulic functions are operating behind the inlet unloader valve, start your testing with the "Inlet Unloader Valve Test." Refer to the following HOC Fault Chart for suggested diagnostic procedures.

### HOC Fault Chart



## 7.1 Inlet Unloader Valve Test

The inlet unloader valve could become stuck in the UNLOADED position, bypassing the spool valve assembly and returning all oil directly to the reservoir. If the inlet unloader valve is stuck in the UNLOADED position, no functions will work regardless of the pumps switch position.

The inlet unloader valve can also be stuck in mid-position between the WORK position and UNLOADED position. If this occurs, the oil will be split between the reservoir and spool valve assembly causing functions to operate slowly.

### 7.1.1 Special Tools

The following special tools are required to test the inlet unloader valve.

2 - #6, 37° JIC plugs

2 - #6, 37° JIC caps



*Make sure hydraulic oil is at operating temperature before performing the test so the truck performs as efficiently as possible and is at operating temperature.*

### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

## 7.1.2 Prepare for Test

1. Clean area around the sense line at inlet unloader valve. Be careful not to let contaminants such as dirt or paint chips in.
2. Disconnect the flow control sense line (Figure 27, Item 1) and N.O. valve line (Figure 27, Item 2) from tee at inlet unloader valve. Cap both fittings at tee (Figure 27, Item 3). Plug both lines (Figure 27, Item 4).

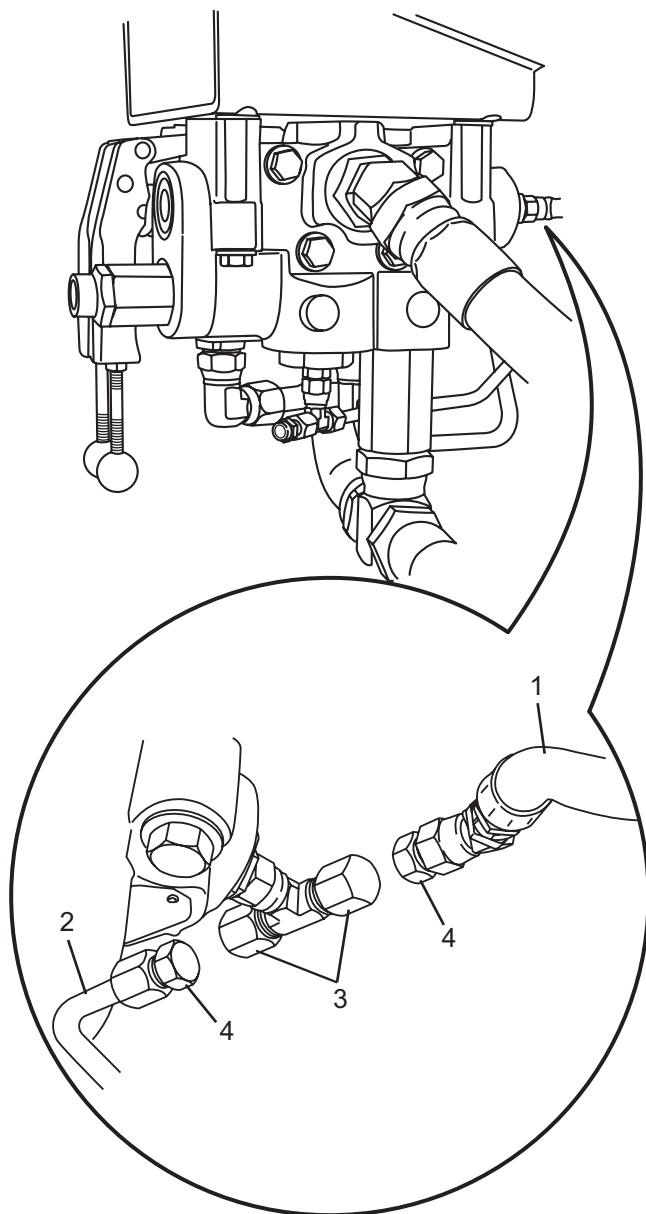


Figure 27

HOC020

## 7.1.3 Inlet Unloader Valve Test Procedure

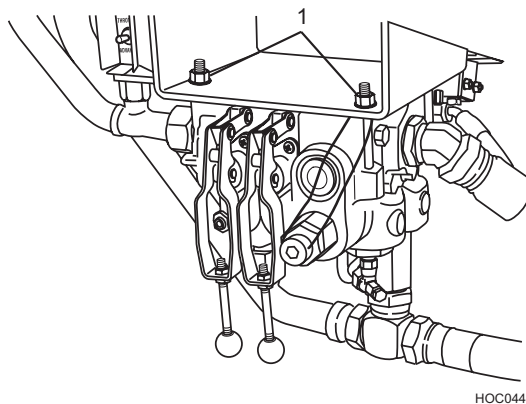
1. Check several functions individually.
2. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
3. Analyze test results:
  - If all functions are operating normally, the problem is not with the inlet unloader valve. Proceed to Step 4.
  - If all functions are not operating or are slow, proceed to "Inlet Unloader Valve Troubleshooting."
4. Remove plug from inlet unloader valve port.
5. Remove plugs from the N.O. valve sense line. Install the N.O. valve line to the inlet unloader valve fitting.
6. Tighten all fittings.
7. Remove your company's Lockout/Tagout procedure and return truck to normal operation. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
8. Check for leaks.
9. Test flow control. Refer to 7.2 Flow Control Test on page 5-20.

## 7.1.4 Inlet Unloader Valve Troubleshooting



*The inlet unloader valve must be serviced as an assembly for proper operation of the inlet unloader valve because the large spool is a "lapped fit" to the housing.*

1. Check the torque on the inlet unloader valve-to-spool valve assembly bolts and the inlet unloader valve-to-plate bolts.
  - a. Loosen and retorque inlet unloader valve-to-mounting plate bolts (Figure 28, Item 1) to 30 ft. lbs. (41 N•m). Make sure mounting plate is flat and not warped.



HOC044

Figure 28



- b. Loosen and retorque inlet unloader valve-to-spool valve assembly bolts (Figure 29, Item 1) to 34 ft. lbs (46 N•m).

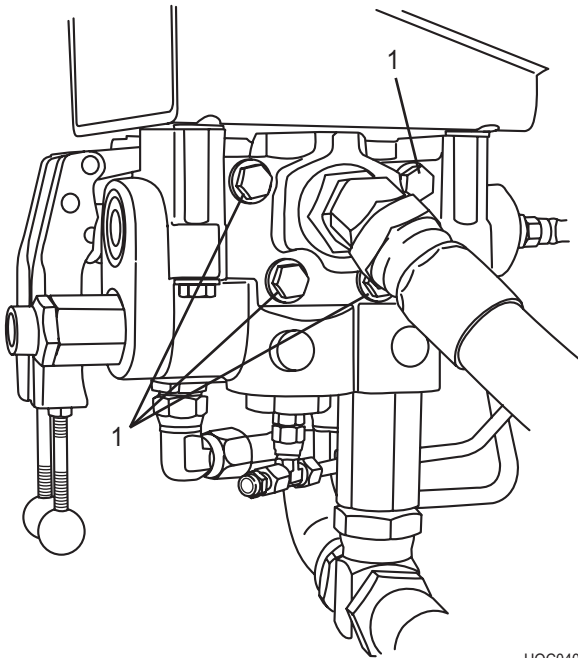


Figure 29

HOC040

- c. Verify for proper operation of the inlet unloader valve after troubleshooting. Repeat 7.1.3 Inlet Unloader Valve Test Procedure on page 5-19.

4. Remove the large nut that the sense line fitting was threaded into from the inlet unloader valve.
5. Using a punch or rod (Figure 30, Item 1) push on the large spool through the sense line hole in the large nut. The large spool should move in approximately 9/16 in. (14 mm) before stopping. The internal spring should return the large spool easily when the punch is removed. If the large spool binds or is sticky, it is probably contaminated and will have to be removed for cleaning and inspection.

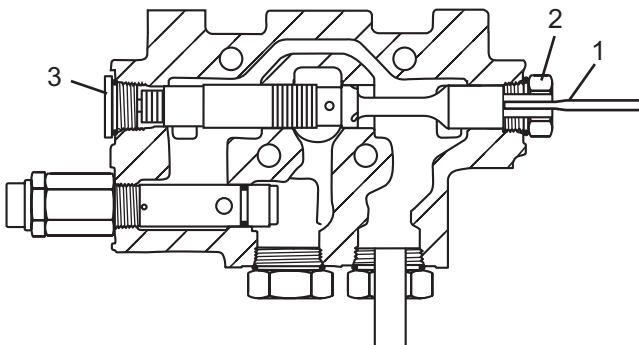


Figure 30

HOC018a

- a. Remove the large hex end cap (Figure 30, Item 2) with a wrench. Remove the opposite end cap (Figure 30, Item 3) with a 5/8 in. hex wrench. The small spool will be exposed. Push on the small spool with a soft object and slide the spool valve assembly out of its cavity.

- b. Examine the large spool (Figure 31, Item 1), spring (Figure 31, Item 2), and small spool (Figure 31, Item 3) for score marks and damage. If any component is damaged or scored, the inlet unloader valve must be replaced as a unit.

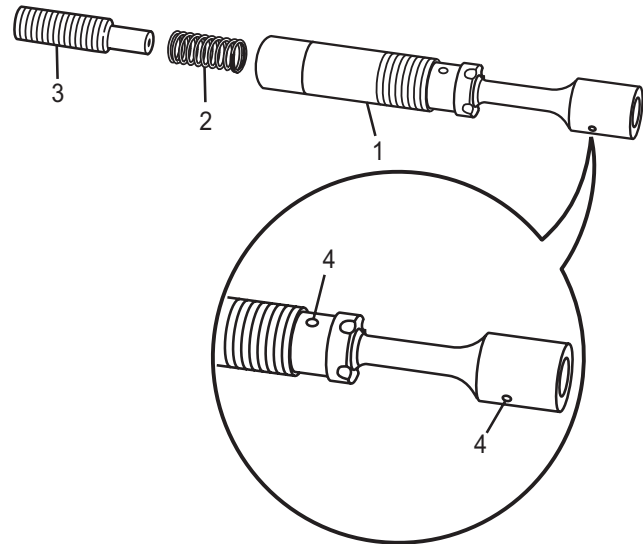


Figure 31

HOC045

- c. Check for contamination by blowing through each orifice (Figure 31, Item 4) located in the large spool. These orifices must be open or the inlet unloader valve will not function properly. Clean all components thoroughly with WD-40 or an equivalent product. Also clean the cavity in the inlet unloader valve housing.
- d. Assemble the spools and spring. Install the assembly into its cavity. Check for free movement of large spool once installed in housing. Install the hex head end cap, if removed, and the large nut.
- e. Verify for proper operation of inlet unloader valve after troubleshooting. Repeat 7.1.3 Inlet Unloader Valve Test Procedure on page 5-19.

## 7.2 Flow Control Test

You can test for proper operation of the flow control by checking the oil flow at the sense line port.

### **CAUTION**

**Do not operate any functions while performing the Flow Control Test Procedure. The operation of any function will cause high pressure in the hydraulic system.**



*Make sure hydraulic oil is at operating temperature before performing the test so the truck performs as efficiently as possible and is at operating temperature.*



## SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

The flow control test can be performed at the flow control (Figure 32, Item 1) or the flow control sense line (Figure 33, Item 1) connection at the inlet unloader valve (Figure 33, Item 2).

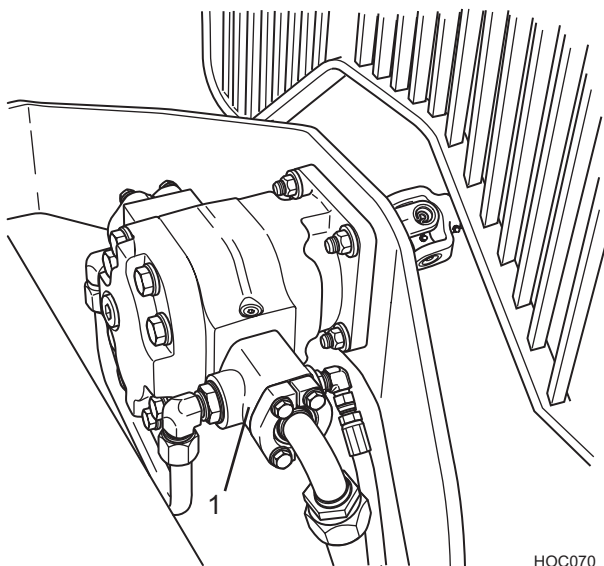


Figure 32

HOC070

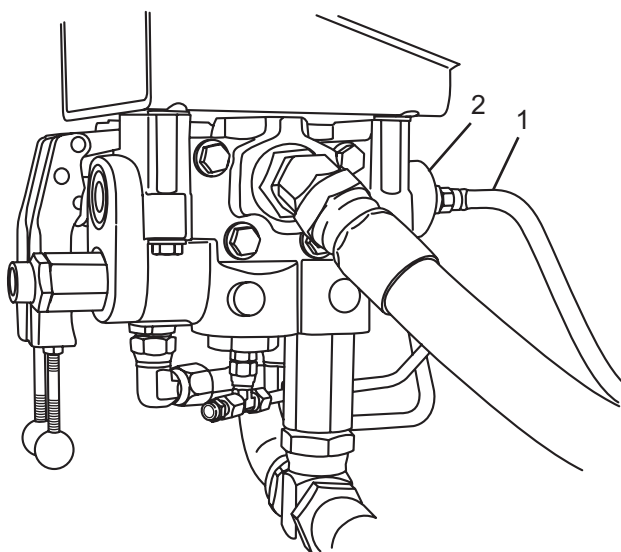


Figure 33

HOC071

## 7.2.1 Prepare Test at Flow Control

1. Clean the flow control. Disconnect the sense line (Figure 34, Item 1) at the flow control. Be careful not to let contaminants such as dirt or paint chips in.
2. Install a plug (Figure 34, Item 2) in sense line.
3. Install a shop test hose (Figure 34, Item 3) to the flow control.
4. Place end of shop test hose in large container (Figure 34, Item 4).

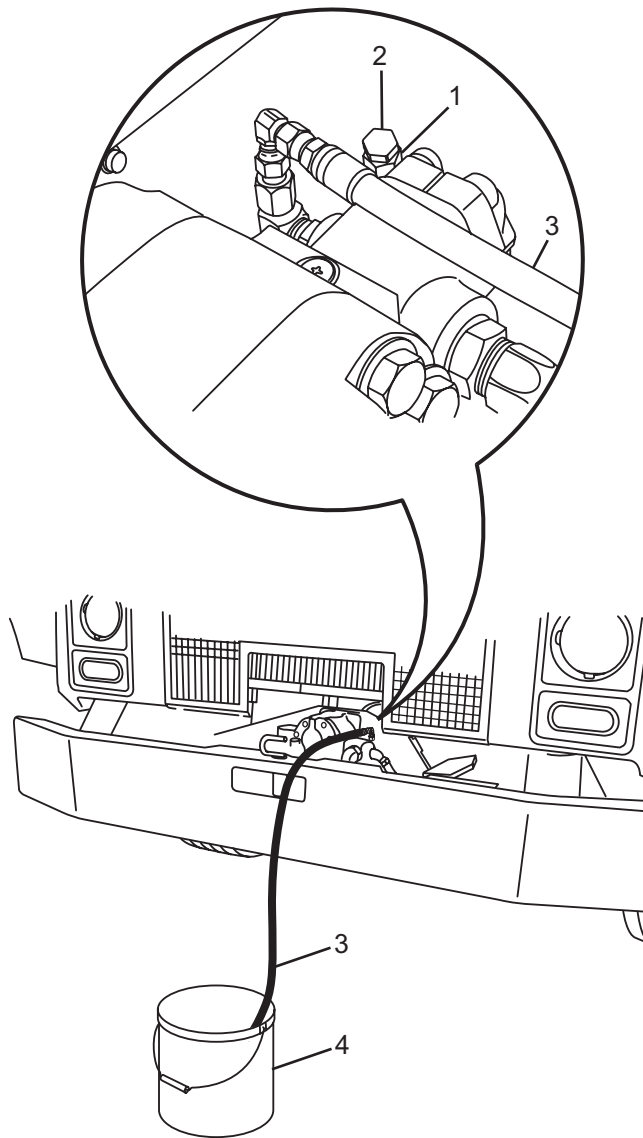


Figure 34

HOC066

## 7.2.2 Prepare Test at Inlet Unloader Valve

1. Clean around the inlet unloader valve tee connection. Disconnect the flow control sense line (Figure 35, Item 1) at the inlet unloader valve tee connection (Figure 35, Item 2). Be careful not to let contaminants such as dirt or paint chips in. Install a cap (Figure 35, Item 3) on tee connection.
2. Connect the sense line to a shop test hose (Figure 35, Item 4).
3. Place end of shop test hose in large container (Figure 35, Item 5).

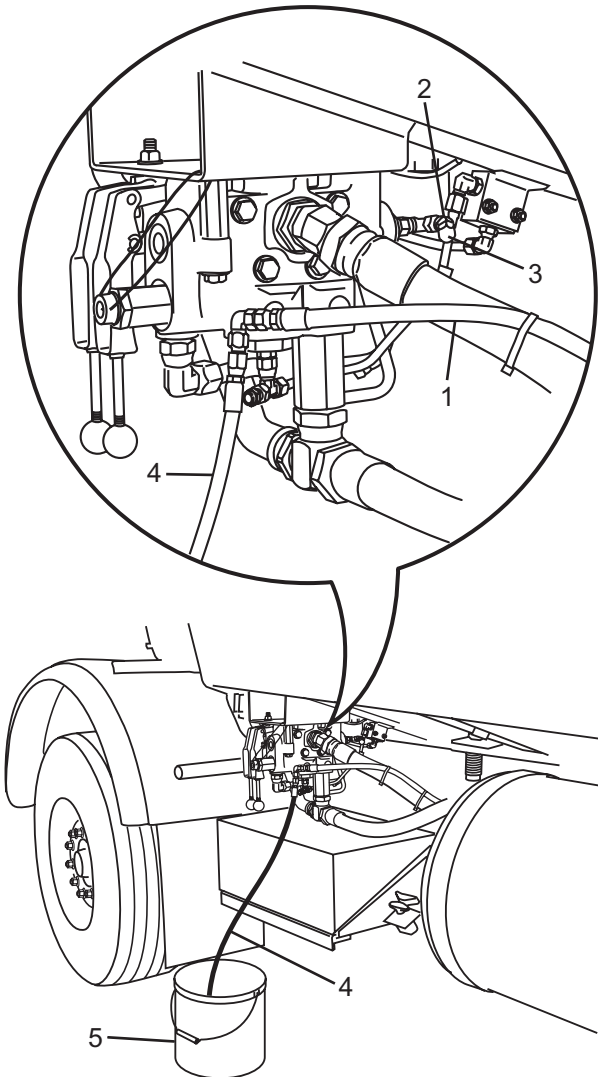


Figure 35

## 7.2.3 Flow Control Test Procedure

### CAUTION

**Do not operate any functions while performing the Flow Control Test Procedure. The operation of any function will cause high pressure in the hydraulic system.**

### SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

1. This test requires two people. Start the truck.
2. At idle, very little or no oil should pass into the container.
3. Increase the engine rpm gradually. Starting between 1400-1600 rpm, flow of oil should start to pass through the test hose.
4. Decrease engine rpm. The flow of oil should stop.
5. Return truck to total lockout. Follow your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
6. Analyze test results:
  - If flow control is operating as described in Steps 1 through 4, the problem is not with the flow control. Proceed to Step 7.
  - If the flow control is not operating normally, proceed to 7.2.4 Flow Control Troubleshooting on page 5-23.
7. Remove test hose and install sense line.
8. Tighten all fittings.
9. Remove your company's Lockout/Tagout procedure and return truck to normal operation. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
10. Check for leaks.
11. Test normally open (N.O.) valve. Refer to 7.3 Normally Open (N.O.) Valve Test on page 5-24.

## 7.2.4 Flow Control Troubleshooting

1. Remove regeneration line (Figure 36, Item 1) from flow control. Install cap (Figure 36, Item 2) on regeneration line.
2. Remove sense line (Figure 36, Item 3) from flow control. Install cap (Figure 36, Item 4) on sense line.

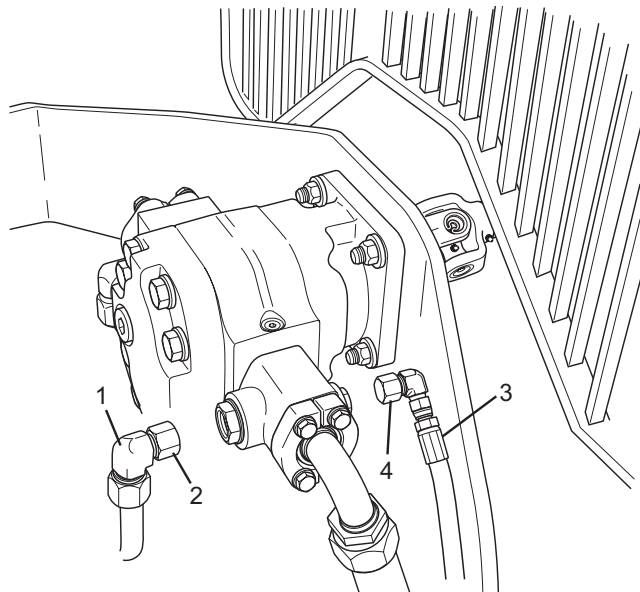


Figure 36

HOC041

3. Remove the flow control from the hydraulic system. Use caution not to allow contaminants from entering the system.
4. It may be necessary to install a different orifice (Figure 37, Item 1) in the flow control to obtain the 1400-1600 rpm shift range.
  - When performing the Flow Control Test, if the flow control shifted higher than 1600 rpm, install a larger size orifice.
  - If the flow control shifted lower than 1400 rpm, install a smaller size orifice.
  - To change the orifice size, remove snap ring (Figure 37, Item 2).

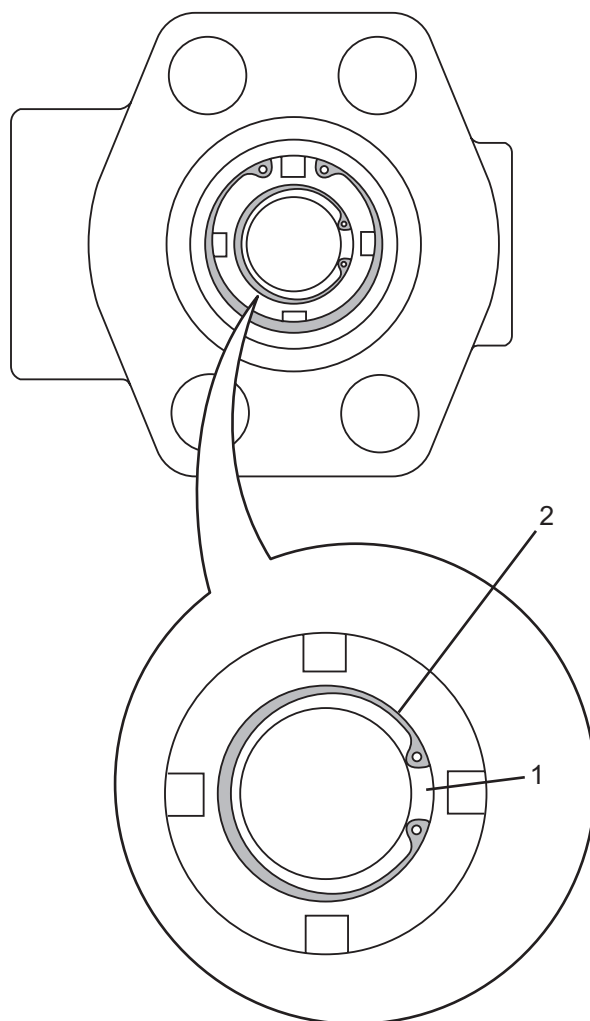


Figure 37

HOC074

5. Disassemble the flow control. Push in on the spool and remove the large retaining ring (Figure 38, Item 1) from the housing.

### **CAUTION**

**Use caution when removing the large retaining ring from the housing. The spool is under spring tension.**

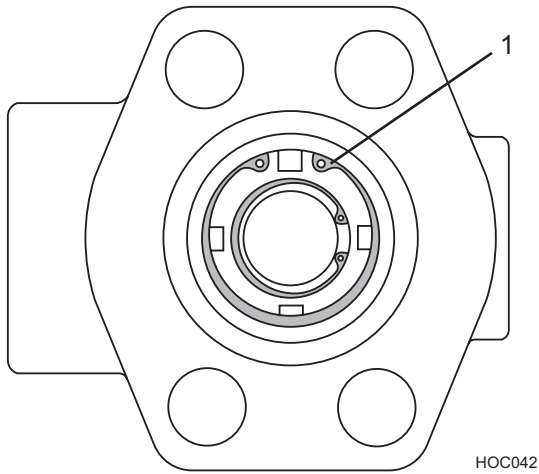


Figure 38

6. Slide the spool (Figure 39, Item 1), spring (Figure 39, Item 2), and washer (Figure 39, Item 3) out of the housing.

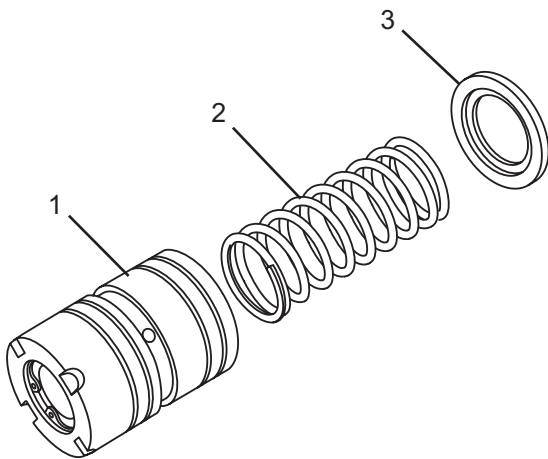


Figure 39

7. Inspect the spool, spring, washer, and housing. Check the spool for damage. Check the spring for breaks. Note the orifice is held in place with a smaller retaining ring (Figure 40, Item 1) on the pump end of the flow control. If removed, the orifice must be correctly installed for proper operation of the flow control.

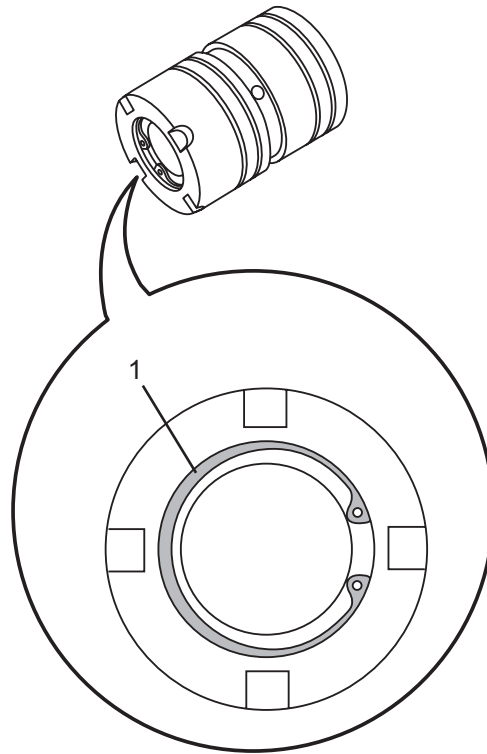


Figure 40

8. Clean the flow control components with WD-40 or an equivalent product. The sense line orifice and regeneration line orifice must be clean for the flow control to operate properly. If the internal parts are broken, scored, or damaged, the flow control assembly must be replaced as a unit.
9. Lubricate the components and assemble.



*Install the retaining rings with the sharp edge facing out away from the spool.*

10. Install flow control and connect regeneration line and sense line.
11. Verify for proper operation of flow control after troubleshooting. Repeat 7.2 Flow Control Test on page 5-20.

## 7.3 Normally Open (N.O.) Valve Test

You can test for proper operation of the N.O. valve by checking for oil flow from its outlet port.

### **CAUTION**

**Do not operate any functions while performing the Normally Open (N.O.) Valve Test Procedure. The operation of any function will cause high pressure in the hydraulic system.**



*Make sure hydraulic oil is at operating temperature before performing the test so the truck performs as efficiently as possible and is at operating temperature.*

## SAFETY NOTICE

**Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.**

### 7.3.1 Prepare Test Port

1. Remove the outlet line (Figure 41, Item 1) from the individual N.O. valve (Figure 41, Item 2) or remove the outlet line (Figure 42, Item 1) from the N.O. valve in the combo block (Figure 42, Item 2).

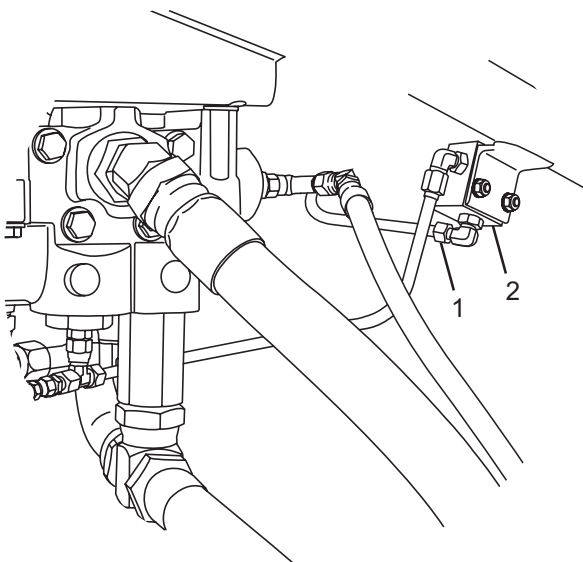


Figure 41

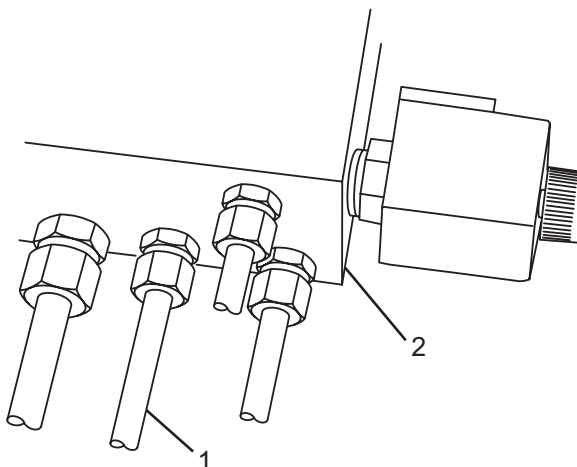


Figure 42

2. Clean the N.O. valve. Disconnect the N.O. valve outlet line at the valve. Be careful not to let contaminants such as dirt or pain chips in.
3. Install a plug (Figure 43, Item 1 and Figure 44, Item 1) in the outlet line.
4. Connect the N.O. valve outlet fitting to a shop test hose (Figure 43, Item 2 and Figure 44, Item 2).
5. Place end of shop test hose in large container (Figure 43, Item 3 and Figure 44, Item 3).

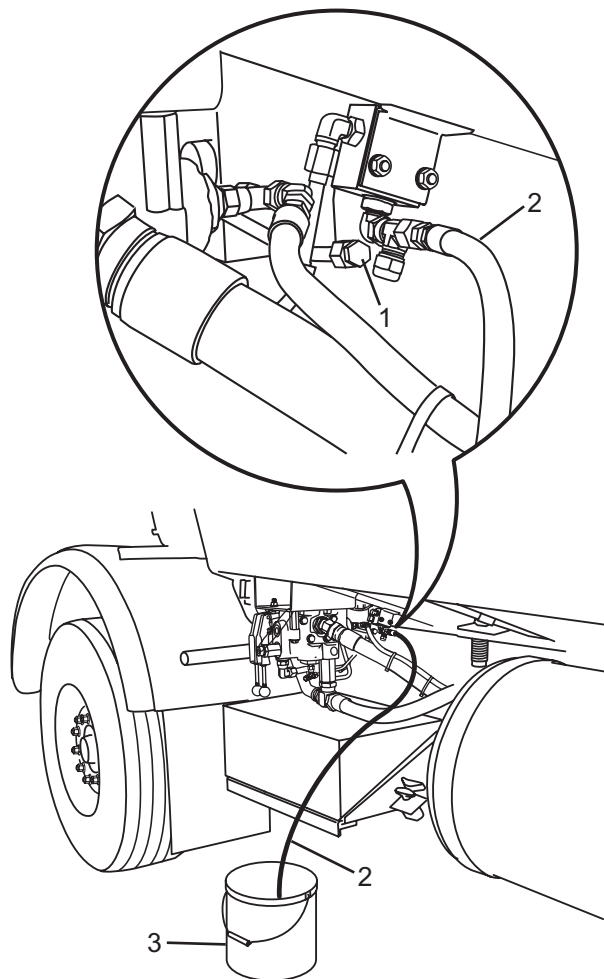


Figure 43

HOC068

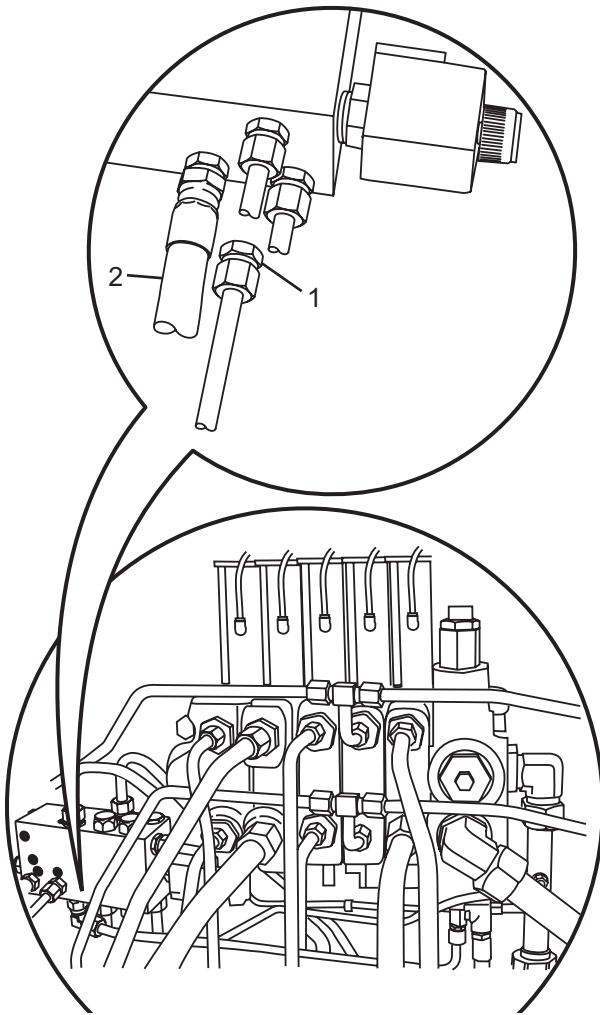


Figure 44

## 7.3.2 N.O. Valve Test Procedure

1. This test requires two people. Turn the N.O. valve switch ON. Start the truck.
2. No oil should pass into the container.
3. Turn the N.O. valve switch OFF.
4. A steady flow of oil should pass through the test hose.
5. Turn the N.O. switch ON.
6. Return truck to total lockout. Follow your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
7. Analyze test results:
  - If the N.O. valve is operating normally, the problem is not with the N.O. valve. Proceed to Step 8.
  - If the N.O. valve is not operating normally, proceed to "N.O. Valve Troubleshooting."
8. Remove test hose and install outlet line.
9. Tighten all fittings.

10. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
11. Check for leaks.
12. Test pump. Refer to 7.4 Pump Snap Test on page 5-27.

## 7.3.3 N.O. Valve Troubleshooting

1. Have someone turn the ignition switch ON, and pump switch or E-STOP button ON, while you listen for the 12-volt solenoid to click OPEN and CLOSED. If no clicking is heard, check the 12-volt power supply to the N.O. valve. If the valve has power, go to Step 2.
2. Perform an ohm test on the solenoid. Set your multimeter to the proper ohms scale. Connect the multimeter (Figure 45, Item 1) leads to the solenoid. Multimeter should indicate a reading between 7 to 9 ohms. If reading is within specification, go to Step 3.

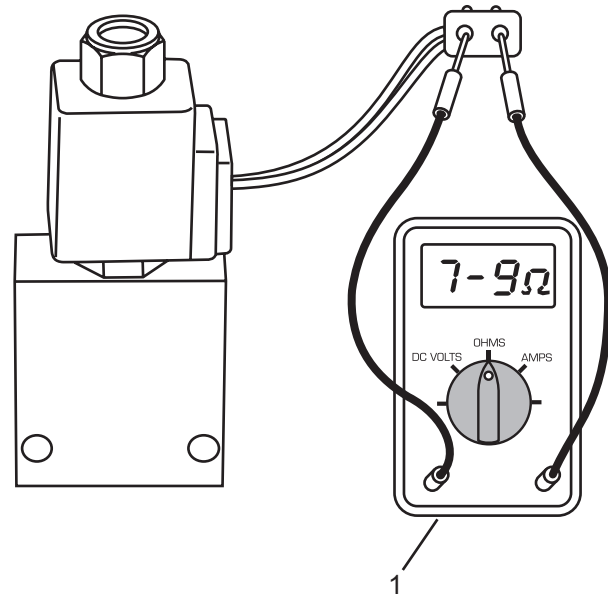


Figure 45

HOC058



3. Remove the cartridge from the valve for cleaning. The cartridge can be cleaned with WD-40 or an equivalent product. If you shake the cartridge, the center spool (Figure 46, Item 1) in it should move freely and rattle. If the center spool sticks or binds, the cartridge must be replaced.

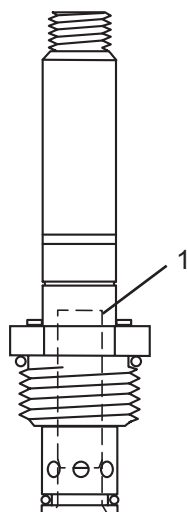


Figure 46

HOC059

4. Assemble the N.O. valve components.
5. Verify for proper operation of N.O. valve after troubleshooting. Repeat 7.3.2 N.O. Valve Test Procedure on page 5-26.

## 7.4 Pump Snap Test

The Snap Test compares a hydraulic pump's efficiency at idle and working revolutions per minute. A pump, which needs replacement, may deliver the correct flows and pressure at working revolutions per minute, but fail to maintain the pressures required at engine idle.

The benefit of completing the Snap Test is that a pump with poor efficiency can be identified before it fails. This means the pump can be removed, the system flushed out and serviced, and a new pump installed without doing a major system clean up as required by a pump which has experienced a failure.

A pump, which has been identified and removed before failure, can be disassembled, analyzed, and there is a good chance it can be repaired economically.



**TIP**

*Make sure hydraulic oil is at operating temperature before performing the test so the truck performs as efficiently as possible and is at operating temperature.*

To perform the Snap Test, install a 0-5000 psi gauge in the test port of the spool valve inlet.

### 7.4.1 Snap Test Procedure

1. Reference the instructions for "Set Main Relief Pressure" for the appropriate model.

2. Check the main pressure while you perform several functions individually using throttle advance. At throttle advance, the main relief pressure should also be obtained within a few seconds.



**TIP**

*Make sure the function does not have a port relief pressure setting lower than the main relief pressure setting.*

3. At idle, deadhead a function to achieve main relief valve pressure. The gauge should either read main relief valve pressure within a few seconds or lug the engine down until it stops.

### 7.4.2 Interpreting Pump Snap Test

1. Evaluate the results from Step 1 of the Snap Test Procedure.
  - If you are able to achieve main relief valve pressure, proceed to Step 2 below.
  - If you are unable to achieve main relief valve pressure, compare the results between Step 1 and Step 2 of the Snap Test Procedure.
    - If you are unable to achieve main relief valve pressure using other functions, remove and service the pump before catastrophic failure occurs.



**TIP**

*After installing a new pump, always perform the Snap Test.*

- If the main relief pressure could be achieved using other functions, a hydraulic or electrical problem exists in the hydraulic system with low pressure.
2. Compare your Snap Test pressure readings between idle and throttle advance, Step 1 and 3 of Snap Test Procedure. The main relief pressure setting should be achieved at both idle and throttle advance.
    - If the gauge reads main relief valve pressure at idle and throttle advance, the pump is OK.



**TIP**

*As the engine rpm increases, the pump produces more flow and a high pressure reading can be observed. It is not unusual to see a 100 psi difference between the idle reading and the throttle advance reading.*

- If the gauge reads main relief valve pressure at throttle advance but not at idle, remove and service the pump before catastrophic failure occurs.



**TIP**

*After installing a new pump, always perform the Snap Test.*

# Hydraulic Overspeed Control

## 7.5 Pump Vacuum Test

The service life and performance of the pump on your refuse vehicle depends on an unobstructed oil flow being available to the pump at all times. Any restrictions between the reservoir oil supply and pump, which would restrict this flow normally, appear as higher than normal vacuum at the pump inlet (Figure 47).

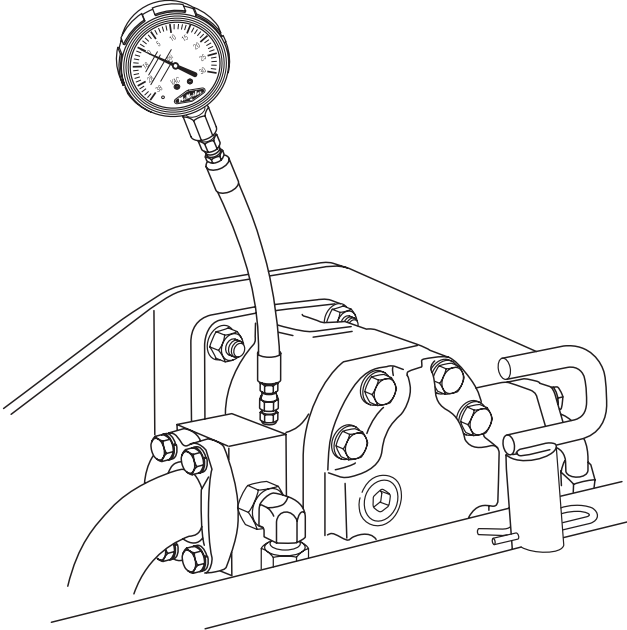


Figure 47

HOC009



*Make sure hydraulic oil is at operating temperature before performing the test so the truck performs as efficiently as possible and is at operating temperature.*

### 7.5.1 Special Tools

The following special tools are required to perform the pump vacuum test. They are part of the McNeilus Hydraulic test kit available from your nearest McNeilus branch:

0-30 vacuum gauge (Figure 48, Item 1)

Female to male 37° JIC adapter (Figure 48, Item 2)

10 in. hose with 37° JIC swivel on both ends (Figure 48, Item 3)

Depending on pump, one of the following is also required:

- (O-Ring to 37° JIC) small top port in center section of pump
- (O-Ring to 37° JIC) large front port in front cover of pump

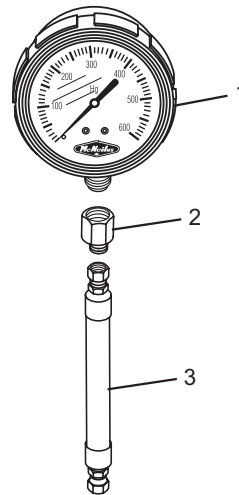


Figure 48

If you drill the test port, a 1/8 in. taper pipe fitting to adapt the hose is required.

### 7.5.2 Prepare Gauge Port

1. Locate the gauge port. The port can be:
  - a. The O-Ring plug (Figure 49, Item 1) located in the center section on the inlet side of the pump, if equipped, or

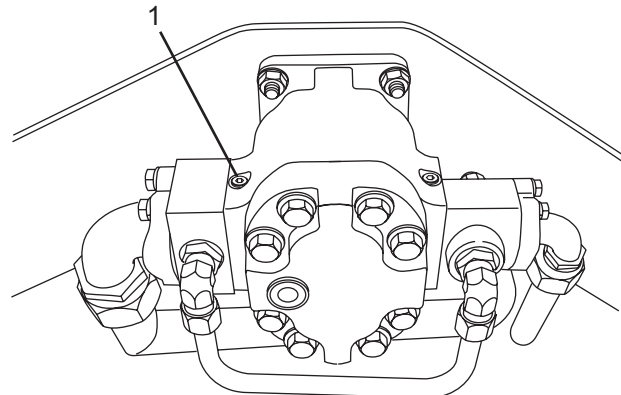


Figure 49

HOC057

- b. The O-Ring plug (Figure 50, Item 1) located in the end cover on the inlet side of the pump, or

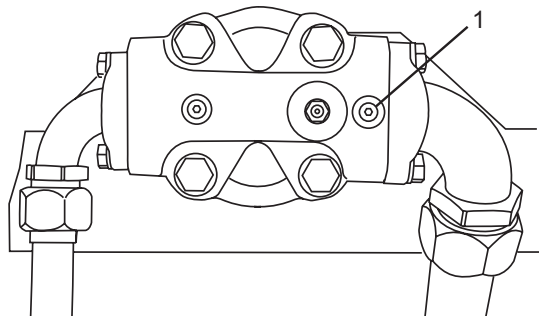


Figure 50

HOC065



- c. The regeneration line connection (Figure 51, Item 1). This port can still be used by removing the line and capping the line, or

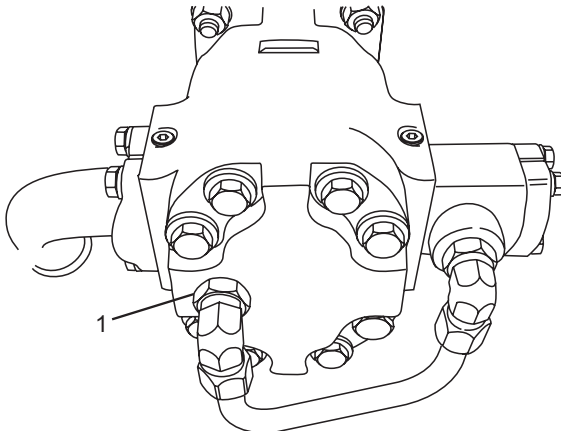


Figure 51

- d. If necessary, drill a 1/8 in. taper NPT port in the pump. Mark the port (Figure 52, Item 1) on the top center section of the pump's inlet side. Remove the inlet block from the pump and place a rag into its oil passage to prevent chips from entering. Also protect the inside of the pump from contamination by placing a rag in the inlet passage.



*Apply beeswax to the flutes of the drill bit before breaking through the wall of the pump. This will help prevent contamination from entering the oil passage.*

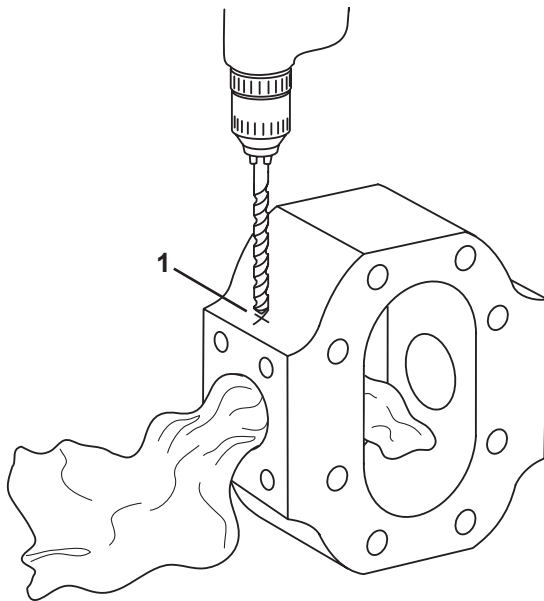


Figure 52

HOC018

2. Clean area around the gauge port. Be careful not to let contaminants such as dirt or paint chips in.
3. Remove plug from gauge port.

## 7.5.3 Setup Gauge

1. Install a 10 in. hose (Figure 53, Item 1), a female to male 37° JIC adapter (Figure 53, Item 2), a 30 in. vacuum gauge (Figure 53, Item 3). Install the proper adapter (Figure 53, Item 4) to the hose. Install the gauge assembly to the port. Tighten all fittings.

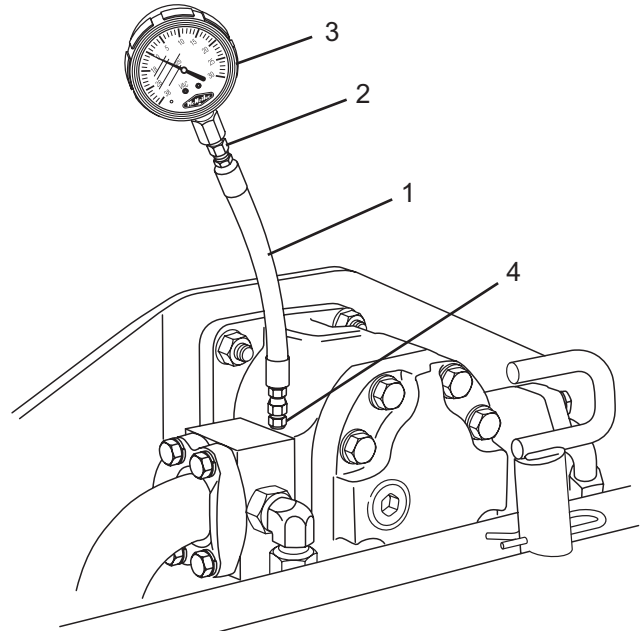


Figure 53

## 7.5.4 Pump Vacuum Test Procedure

1. This test requires two people. Advance the throttle to 1400-1600 rpm. Check and record vacuum on gauge.
2. Advance the throttle to maximum engine rpm. Check and record vacuum on gauge.
3. Return truck to total lockout. Follow your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
4. Remove test gauge and adapter.
5. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
6. Tighten all fittings.
7. Check for leaks.

## 7.5.5 Interpreting Pump Vacuum Test

Normal vacuum readings should be less than 5 in. Hg at all rpm readings. A reading of 5 in. Hg or more indicates a pump is inefficient or the suction side of the hydraulic system has failed.

1. Make sure the 2 in. gate valve (Figure 54, Item 1) is fully open and not partially closed. A nylon strap (Figure 54, Item 2) must be installed on the gate valve to prevent vibration from closing the gate valve or inadvertent closing of the valve.



*Anytime the gate valve is closed and reopened, the nylon strap must be replaced.*

2. Check the 100 mesh filter strainer (Figure 54, Item 3) in the reservoir for contamination or blockage. The strainer could be covered by an object such as a rag.
  - a. Drain the reservoir and wipe inside clean with a lint-free cloth.
  - b. Replace the 100 mesh filter strainer.
  - c. Replace the return line filter (Figure 54, Item 4) and its O-ring.
  - d. Refill the reservoir with the proper oil.
3. Check the suction hose (Figure 54, Item 5) between the reservoir and the pump for damage. The hose could be pinched or collapsed.
  - SAE 100R4 spec hose must be used in this application to prevent suction from internally collapsing the hose.
  - If an incorrect hose is installed, the inner liner may collapse from the vacuum over a period of time.
  - The hose with a collapsed liner may appear normal on the outside.
4. Check for an obstruction in the section hose between the reservoir and pump. Check all fittings and connections if an obstruction is suspected.
5. After performing the above checks, recheck the vacuum reading using the "Pump Vacuum Test" procedure.

If the reading remains above 5 in. Hg, the pump must be removed and serviced before it totally fails. Early detection of a failing pump could prevent the hydraulic system from becoming contaminated.

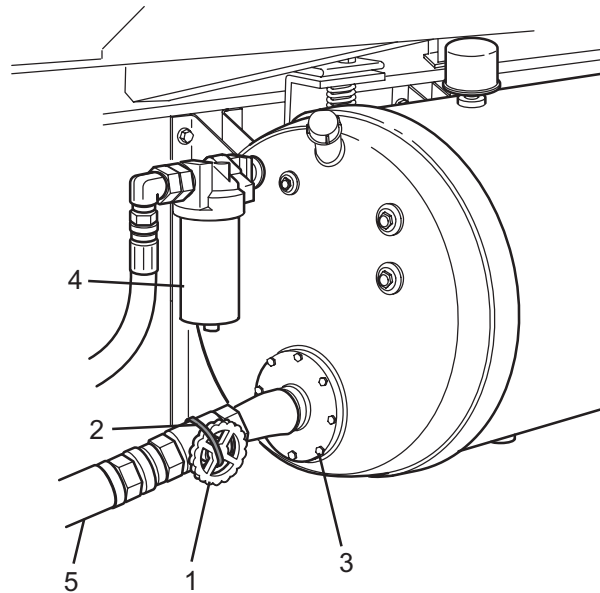
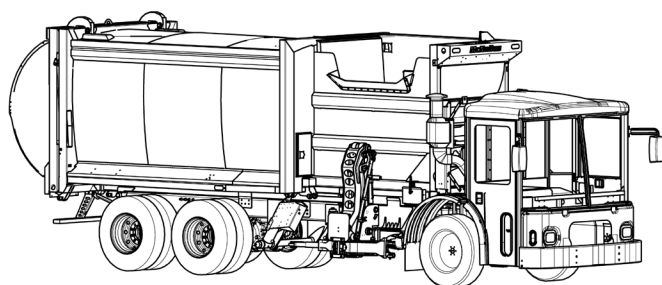


Figure 54

HOC038



# Electrical

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## 1.0 Control Box

### 1.1 Control Box

The control box (Figure 1) contains the E-STOP (emergency stop) button, rocker switch for the refuse vehicle functions, lights, pump, options.

No.	Position	Normal Use or Reading
1	E-STOP Button	Disables all Hydraulic and Pneumatic body functions, and some Electrical body functions.
2	FUSE BLOCK	Contains 14 fuses.
3	PUSHER AXLE Pressure Gauge if Installed By McNeilus Truck and Manufacturing, Inc. (Optional)	Indicates air pressure when pusher axle is lowered.
4	PACK and SWEEP Button	Automatically performs the Pack and Sweep Functions.

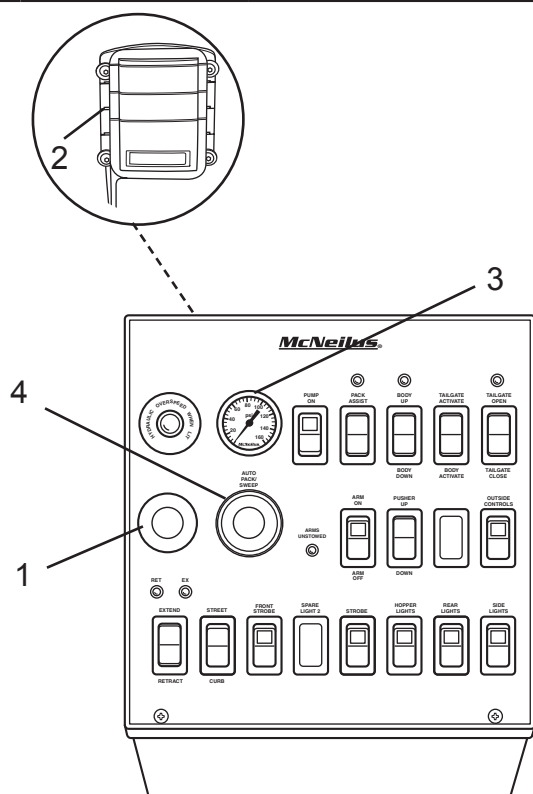


Figure 1

### 1.1.1 Rocker Switch Functions

Accessories and refuse vehicle functions and some options are operated by rocker switches on the top of the control box. Accessories vary depending on your model (Figure 2).

No.	Position	Normal Use or Reading
1	PUMP Rocker Switch	Press ON to activate Hydraulic Functions. Press OFF to disable Hydraulic Functions.
2	PACK/ ASSIST Rocker Switch	Press UP to raise packer assist panel. Press DOWN to lower packer assist panel.
3	BODY Rocker Switch	Press and hold UP to raise body. Press and hold DOWN to lower body.
4	ACTIVATE Rocker Switch	Press and hold TAILGATE ACTIVATE to enable tailgate functions. Press and hold BODY ACTIVATE to enable body functions.
5	TAILGATE Rocker Switch	Press and hold OPEN to open tailgate. Press and hold CLOSE TO close tailgate.
6	PUSHER AXLE Rocker Switch (Optional)	Press UP to raise tag axle. Press DOWN to lower tag axle.
7	OUTSIDE CONTROLS Rocker Switch (Optional)	Press top of rocker switch to enable outside controls. Light in rocker switch indicates outside controls are enabled. Press bottom of rocker switch to disable outside controls.
8	SIDE LIGHT Rocker Switch (Optional)	Press top of rocker switch to activate side lights. Light in rocker switch indicates side lights are ON. Press bottom of rocker switch to turn side lights OFF.
9	REAR LIGHT Rocker Switch	Press top of rocker switch to activate rear lights. Light in rocker switch indicates rear lights are ON. Press bottom of rocker switch to turn rear lights OFF.
10	HOPPER LIGHT Rocker Switch (Optional)	Press top of rocker switch to activate hopper lights. Light in rocker switch indicates hopper lights are ON. Press bottom of rocker switch to turn hopper lights OFF.
11	STROBE LIGHT Rocker Switch (Optional)	Press top of rocker switch to activate strobe light. Light in rocker switch indicates strobe lights are ON. Press bottom of rocker switch to turn strobe lights OFF.

No.	Position	Normal Use or Reading
12	FRONT STROBE LIGHT Rocker Switch (Optional)	Press top of rocker switch to activate strobe light. Light in rocker switch indicates strobe light is ON. Press bottom of rocker switch to turn strobe lights OFF.
13	CURB/ STREET Rocker Switch (Optional)	Press CURB to activate curb side cab controls. Press STREET to activate street side cab controls.
14	EXTEND/ RETRACT Rocker Switch	Press and hold EXTEND to extend pack and sweep. Press and hold RETRACT to retract pack and sweep.
15	ARM Rocker Switch	Press ON to enable Arm Functions. Light in rocker switch indicates Arm Functions are enabled. Press OFF to disable Arm Functions.

## 1.1.2 Indicator Light Functions

The indicator lights are used to display the status of various functions (Figure 3).

No.	Position	Normal Use or Reading
1	HYDRAULIC OVERSPEED Indicator Light	Light indicates when HYDRAULIC OVERSPEED CONTROL (HOC) is on.
2	PACK ASSIST Indicator Light	Light ON when Panel is not raised to home position.
3	BODY UP Indicator Light	Light indicates when body is not lowered to HOME position.
4	TAILGATE OPEN Indicator Light	Light indicates when tailgate is not in CLOSED position.
5	ARM UNSTOWED Indicator Light	Light indicates when arm is in the UNSTOWED position.
6	EXTEND Indicator Light	Light indicates pack and sweep is extended in the EXTEND position.
7	RETRACT Indicator Light	Light indicates when pack and sweep is retracting to HOME position.

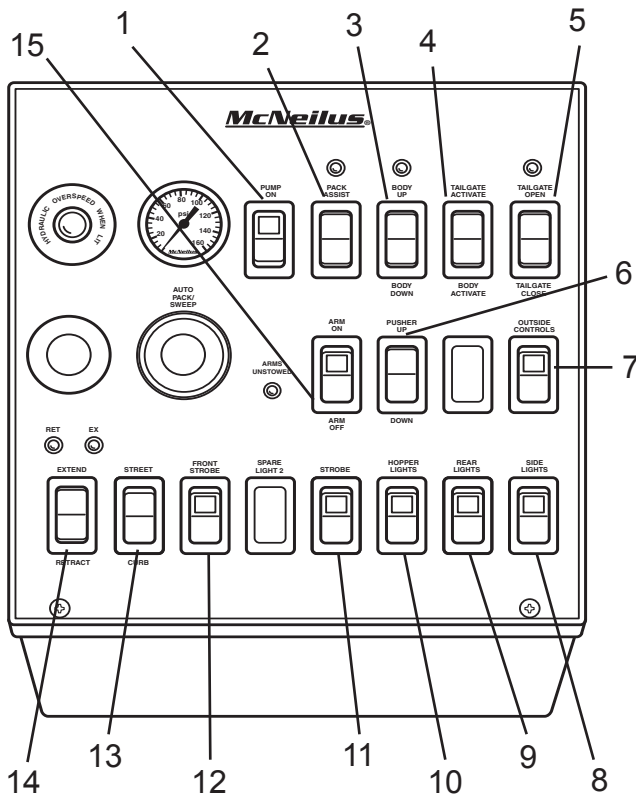


Figure 2

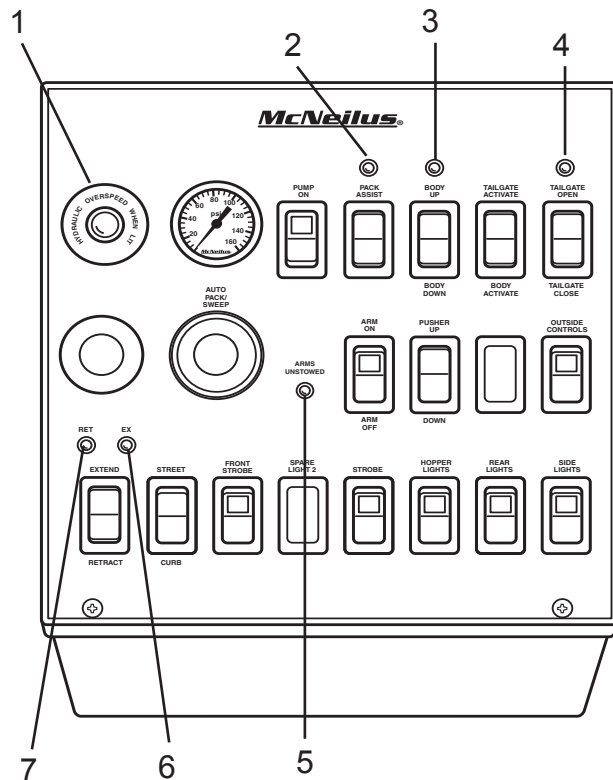


Figure 3



## 1.1.3 Fuse Box

The fuse box protects the control box from an overloaded condition (Figure 4).

No.	Amp	Description
1	15	Spare Light
2	15	Tailgate Alarm Relay
3	15	Strobe Lights
4	15	Rear Lights (circuit #1)
5	15	Rear Lights (circuit #2)
6	15	Hopper Lights
7	15	Pack Assist
8	15	Prox Power - Fuses all proximity switches as well as the side door relay (9) and E-Stop relay (8)
9	15	Pack at Idle
10	5	Pack and Sweep
11	5	Tag Axle
12	5	Outside Controls
13	25	Battery Power
14	25	Battery Power
15	—	Spare
16	—	Spare

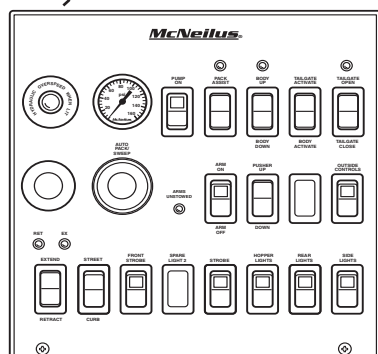
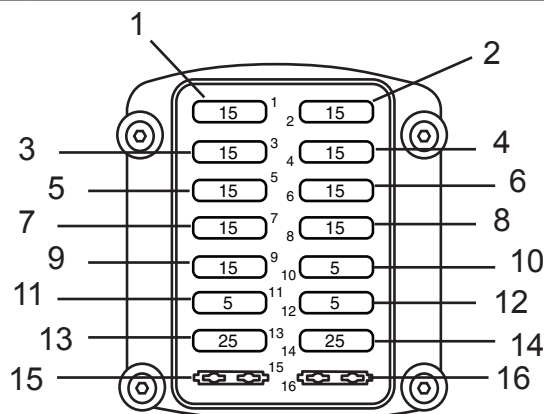


Figure 4

## 1.1.4 Relays

No.	Description
K1	BATTERY - Supplies power to fuses F9-F12 if power switch is on and E-STOP is pulled up (latching circuit)
K2	BATTERY - Supplies power to fuses F1-F8 when ignition is turned on
K3	TAILGATE ALARM - Turns tailgate alarm on when HED module sends signal to it
K4	BRAKE IS ON - Supplies power to joystick selector switch if brake signal is received
K5	OUTSIDE CONTROLS - Supplies power to air turn-on solenoid for all functions except for body lift and pack assist panel
K6	PACK AT IDLE - Supplies power to unloader valve when HED module sends signal to it
K7	POWER HOLD - Part of latching power circuit
K8	E-STOP - Part of latching power circuit
K9	SIDE DOOR - Supplies power to remote E-STOP if side door prox signal is received
K10	STROBE INTERRUPT - Stops strobe function if turn signal is received
K11	PACK AT IDLE - Sends signal to Unloader Relay below overspeed condition or if tailgate is not being used
K12	BRAKE - Sends power to joystick selector switch if brake signal is received
K13	UNLOADER - Switches arm unloader spool on and off depending on overspeed condition
K14	PUMP OFF - Brakes the power latch circuit when the power off switch is depressed
K15	IN NEUTRAL - Disables cab alarm if truck is placed into neutral with arm unstowed and grabber open
K16	GRABBER OPEN - Sends signal to cab alarm if truck is in gear or brake is not applied and grabber is open
K17	TAILGATE/BODY UP - Sends signal to cab alarm if truck is in gear or if brake is not applied and body is up or tailgate is open
K18	STROBE ON WITH PUMP - Turns strobe light(s) on when pump on switch is engaged
K19	WEIGHT INTERLOCK - Allows power to travel to K12 (brake) relay if arm is not overweight
K20	ARM UNSTOWED - Sends signal to cab alarm if truck is in gear or brake is not applied and arm is not stowed
K21	BRAKE IS ON - Disables cab alarm if brakes are applied with arm unstowed and grabber open

## 1.1.5 Pack Count Setting Procedure

There are four (4) indicator lights that indicate the current pack count. The pack count is the number of times the auto-pack will cycle when the auto-pack rocker switch is pressed. The indicator lights are on the Pack Assist, Body Up, Tailgate Open, and Arms Unstowed rocker switches. The number of indicator lights turned on represents the current pack count (see Figure 7, Figure 8, Figure 9, and Figure 10 for indicator lights in correlation with current pack count). The following procedure is to change the pack count from the factory default setting of three (3).

Two people are needed to set the pack count.

1. One person must use the battery disconnect switch to disconnect the battery (see the Safety Section for instructions).
2. The second person should be in the cab to press and hold down the AutoPack/Sweep button and Retract switch simultaneously (Figure 5). Do not let up on the button/switch.

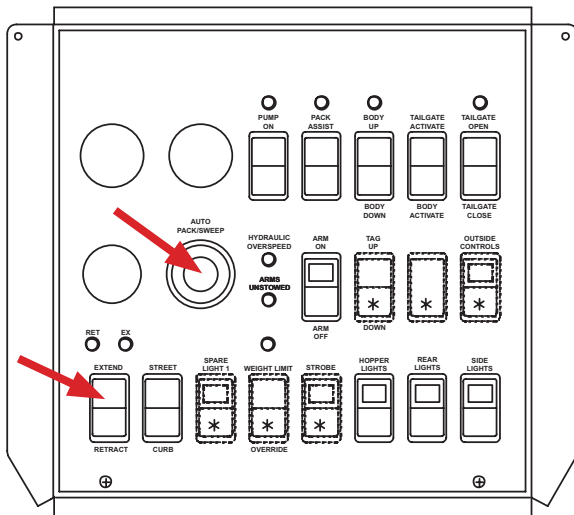


Figure 5

3. The first person must now use the battery disconnect switch to reconnect the battery. The vehicle now has power.
4. The second person in the cab must continue holding down the AutoPack/Sweep button and Retract switch until the RET and EX lights alternately blink (it may take about 5 seconds for the lights to blink) (Figure 6 shows where the RET and EX lights are on the control box).

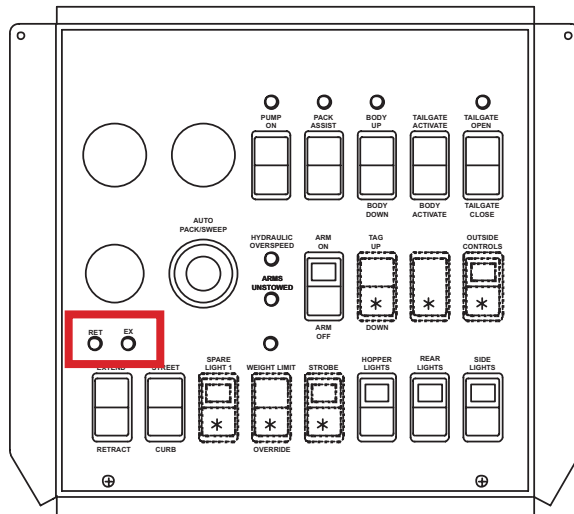


Figure 6

5. When the lights blink, release the AutoPack/Sweep button and Retract switch.
6. The Pack Assist, Body Up, and Tailgate Open indicator lights will be on indicating the factory default pack count of three (3). (NOTE: If the pack count has already been changed from factory default, the number of lights may be different. The same process applies for increasing or decreasing the pack count as described in Step 7.)
7. The Extend rocker switch increases or decreases the pack count. One press of the Extend rocker switch increases or decreases the pack count by one.
8. Press the Extend rocker switch once and the Arm Unstowed indicator light will turn on. The Pack Assist, Body Up, Tailgate Open, and Arm Unstowed indicator lights should all be on indicating a pack count setting of four (4).
9. Press the Extend rocker switch again and the Pack Assist indicator light will light. The Body Up, Tailgate Open, and Arm Unstowed indicator lights should turn off indicating a pack count of one (1).
10. Press the Extend rocker switch again and the Pack Assist and Body Up indicator lights will light indicating a pack count of two (2).
11. One press of the Extend rocker switch increases or decreases the pack count by one. Continue pressing the Extend rocker switch until you have the desired pack count.



Pack Count = 1

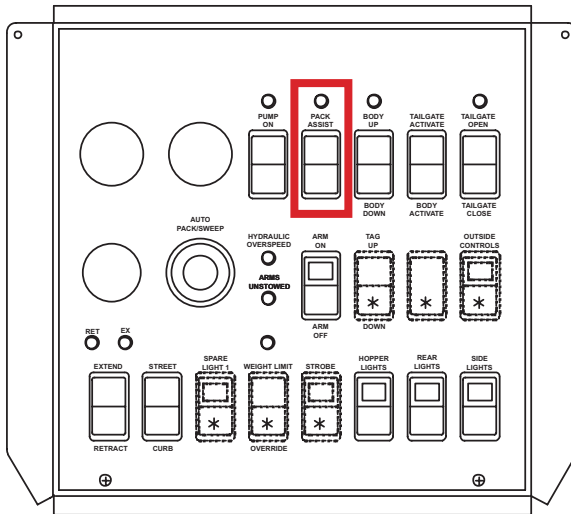


Figure 7

Pack Count = 3

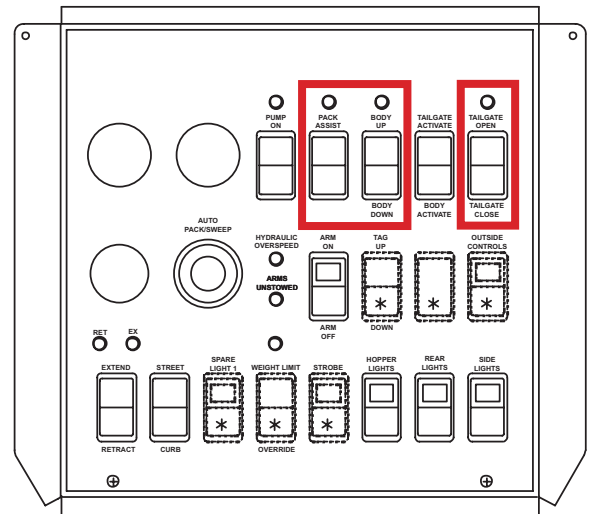


Figure 9

Pack Count = 2

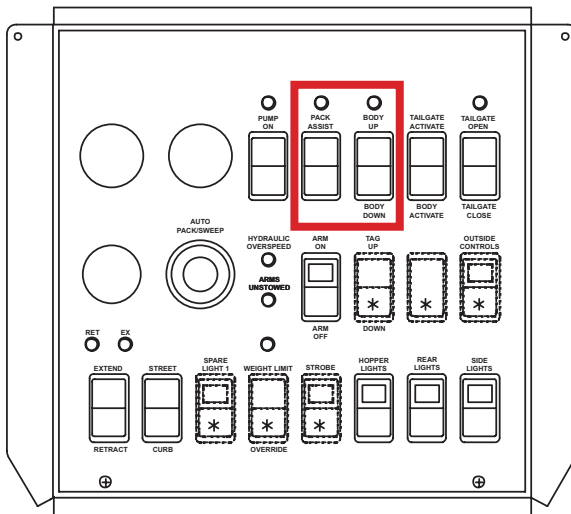


Figure 8

Pack Count = 4

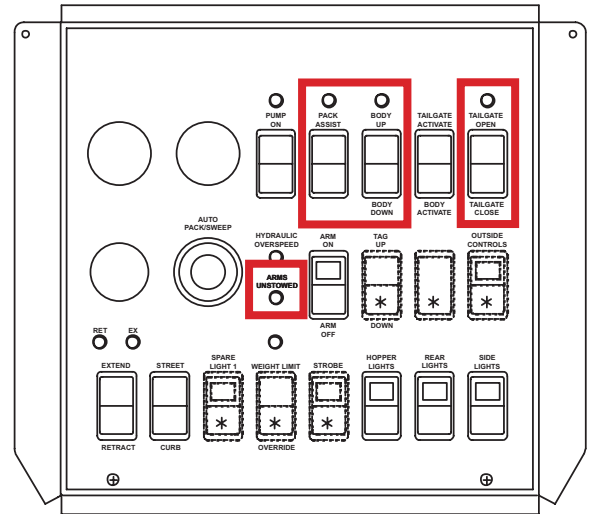


Figure 10

## 2.0 Joystick

### 2.1.1 Joystick Controls

The single lever joystick (Figure 11) controls the movement of both arms and the grabber fingers.

The joystick is spring loaded and will automatically return to the middle (neutral) position when released.

No.	Position	Normal Use or Reading
1	Joystick - FORWARD	Lower Arm Assembly.
2	Joystick - BACK	Raises Arm Assembly.
3	Joystick - RIGHT	Extends Arm Assembly.
4	Joystick - LEFT	Retracts Arm Assembly.
5	Thumb Rocker Switch - TOP	Opens Grabber Fingers.
6	Thumb Rocker Switch - BOTTOM	Closes Grabber Fingers.
7	Finger Switch - TOP	Swings Arm Right/ toward the front of the vehicle.
8	Finger Switch - CENTER	Swings Arm Left/toward the rear of the vehicle.
9	Finger Switch - Bottom	Performs Optional Auto Load Function.

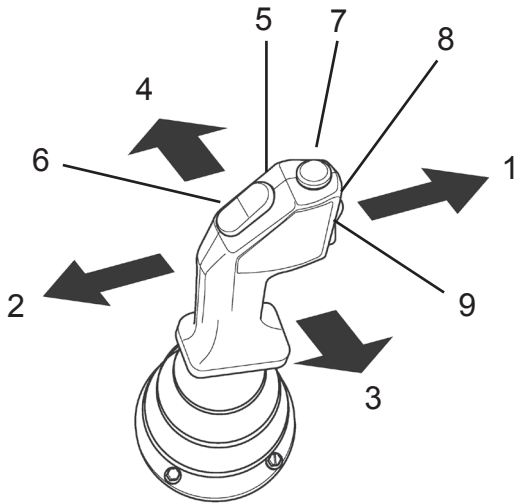


Figure 11

## 3.0 Arm Remote Control Box (Optional)

The Arm Assembly Functions can also be operate from the arm remote control box when the operator is outside the cab (Figure 12). The arm remote control box is normally located inside the curb side door of the chassis cab. The OUTSIDE CONTROL rocker switch in the cab must be activated to enable the use of the Arm Remote Control Box.

No.	Position	Normal Use or Reading
1	ACTIVATE Button	Press ACTIVATE button to activate an arm function.
2	GRABBER Rocker Switch	Press and hold OPEN to open grabber. Press and hold CLOSE to close grabber.
3	ARM Rocker Switch	Press and hold UP to raise arm assembly. Press and hold DOWN to lower arm assembly.
4	E-STOP	Pull UP to enable operation of functions. Push DOWN to disable operation of functions.

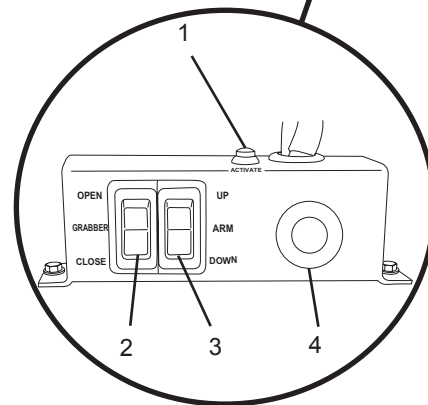
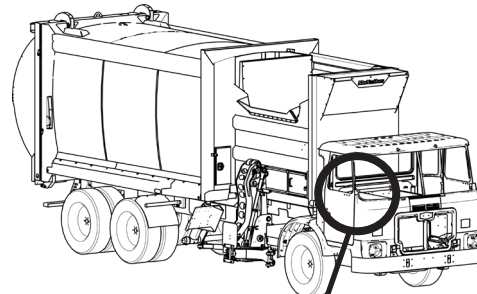


Figure 12

## 4.0 Switches and Sensors

### 4.1 Proximity Switches

A sourcing proximity switch is used to signal position of components on the refuse vehicle. A sourcing proximity switch sends a low amperage, approximately 200 milliamps, positive output signal to the control box when targeted by ferrous metal.

The proximity switch (Figure 13) contains a ferrite core. A metal target directly in front of the proximity switch activates the switch. When the proximity switch senses the metal target, a sourcing 12-volt signal is sent to the control box.

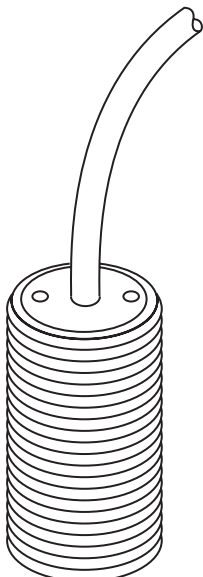


Figure 13

Proximity Switches are fragile and can be damaged easily. DO NOT:

- Hit or tap on the proximity switch with a tool.
- Drop the proximity switch on the floor.
- Weld within 2 ft. (61 cm) of a proximity switch without removing the proximity switch from the refuse vehicle.
- Overtighten the proximity switch nuts when installing.



*Proximity switches are vulnerable to electronic fields. Remove the proximity switch if welding will be done within two feet of its location.*

#### 4.1.1 Proximity Switch Troubleshooting

Preliminary checks of a proximity switch with one LED can help to determine if the failure is caused by a failure of the switch or electrical harness.

When the proximity switch LED is ON, this indicates the switch has operating power, a grounded connection, and the switch is targeted. It also indicates the switch generated an output power signal.

If the LED is OFF when the switch is targeted, a power source, ground connection, or a proximity switch problem exists.

#### 4.1.2 Troubleshooting Proximity Switch With Two LEDs

On a proximity switch with two LEDs, the LEDs (Figure 14, Item 1) can be used to determine the condition of the switch.

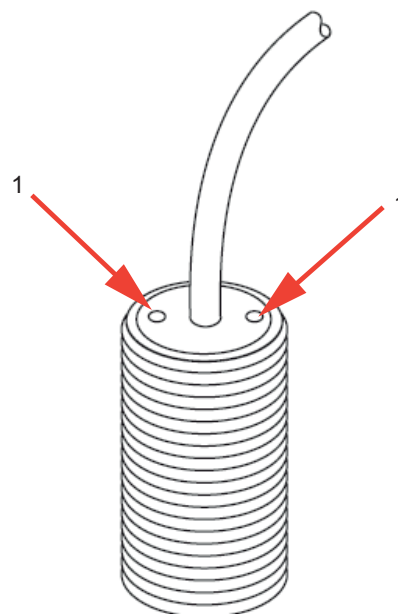


Figure 14

With the proximity switch not targeted, the green LED should be ON. This indicates the switch has a power source and a ground.

If the green LED is OFF, check for a short or loose connection in the harness wiring for the proximity switch power source or ground circuit.

Place a small piece of mild steel such as a washer within 1/8" to 3/16" (3.1 mm to 4.8 mm) in front of the proximity switch. The yellow LED should be ON. This indicates the switch has an output power signal.

If the yellow LED is OFF, test the proximity switch with a proximity switch tester.

## 4.1.3 Proximity Switch Adjustment

Adjust the proximity switch to achieve a gap of 1/8" to 3/16" (3.1 mm to 4.8 mm) between the end of the switch and the metal target (Figure 15, Item 1).

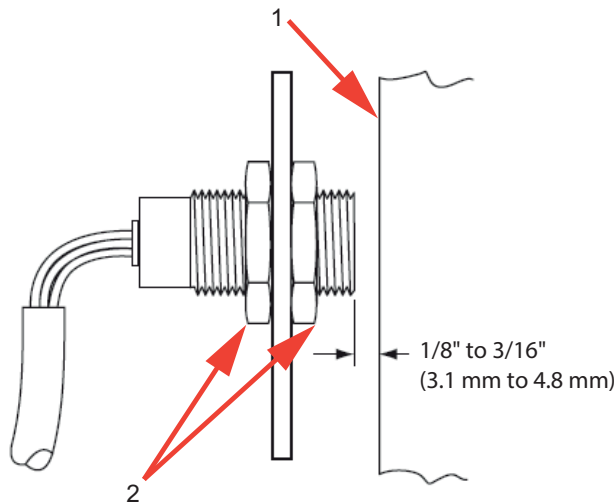


Figure 15



*Do not overtighten or the switch may be damaged.*

## 4.2 Proximity Switch Locations

### 4.2.1 Body Up Proximity Switch

The body up proximity switch is located between the frame rails, under the body (Figure 16). The proximity switch sends a 12V signal to the module when the body is down. If the body is up, the module loses this signal and turns on the body up output, thereby turning on the cab alarm.

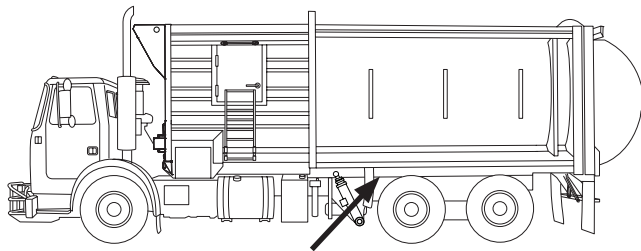


Figure 16

### 4.2.2 Tailgate Proximity Switch

The tailgate proximity switch is located on the side wall support at the tailgate area on the street side (Figure 17). The proximity switch sends a 12V signal to the module when the tailgate is down. If the tailgate is up, the module loses this signal and turns on the tailgate up output, thereby turning on the cab alarm and also turning on the exterior alarm.

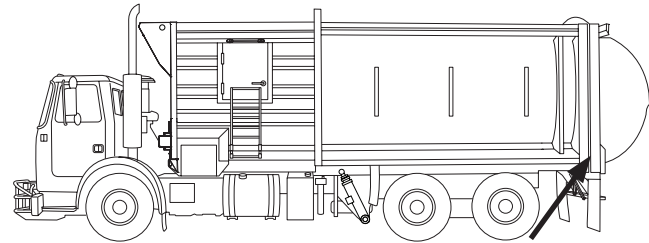


Figure 17

### 4.2.3 Side Door Proximity Switch

The side door proximity switch is located at the side door (Figure 18). If the proximity switch does not see the target, all body hydraulic functions will stop and all indicator lights on the cab control box will flash until the side door proximity switch reads the target.

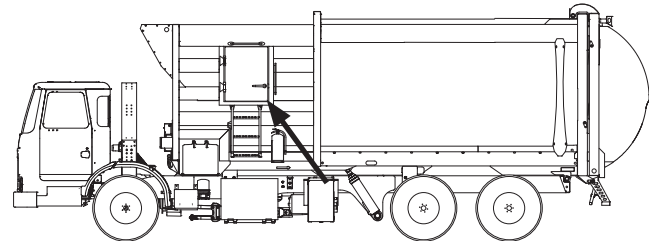


Figure 18

### 4.2.4 Arm Swing and Arm Stowed Proximity Switches

These proximity switches are wired in series (Figure 19). The module uses these proximity switch inputs to signal alarms and to turn on indicator lights if the arm is not centered/stowed or the arm is not centered (models with swing only).

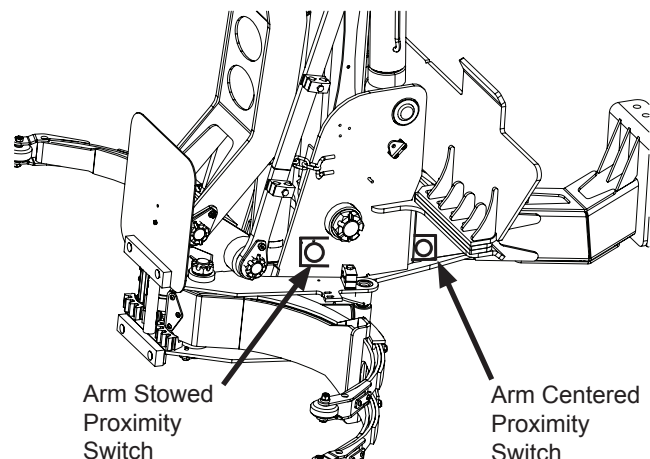


Figure 19

## 4.2.5 Grabber Open Proximity Switch

The grabber open proximity switch is located on the grabber (Figure 20) and is wired to the in-cab, out of dimension alarm. This proximity switch may only be on late model units.

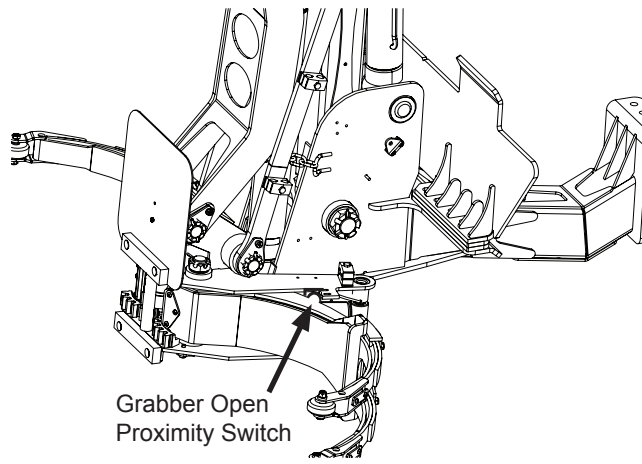


Figure 20

## 4.2.6 Top Door/Pack Assist Proximity Switch

The top door/pack assist proximity switch sends a signal to the module indicating that the top door is in the open position. Proximity switch is located inside the hopper on the curb side hopper wall (image of location not provided).

**Interlock Alert:** If the pack assist panel is not fully raised or if this proximity switch fails, the arms raise function will be disabled.

## 4.2.7 Packer/Ejector Proximity Switches

The packer/ejector proximity switches are located on the street side front of body (on the outside of the wall) (Figure 21). These proximity switches allow the AutoPack function to work by telling the module if the packer/ejector is extended or retracted.

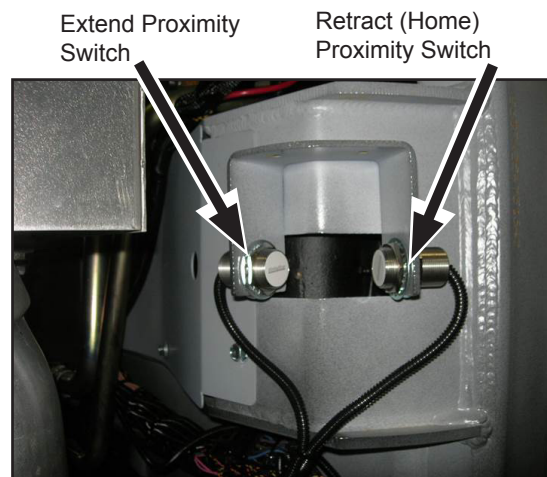


Figure 21

## 4.3 Ignition Switch

The ignition switch (Figure 22, Item 1) in the ON position provides ignition power to the control box and ignition power to the side door proximity switch.

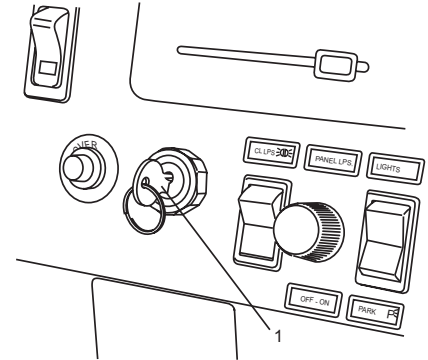


Figure 22

## 4.4 Arm Position Sensors

### Rotary Sensors and Linear Sensors

If the AutoReach has the AutoLoad feature, the arm will be equipped with either rotary or linear sensors. This is so the module knows where the arm is at all times. It can then sense where the can is picked up and where it needs to be returned to. If these malfunctions, AutoLoad will not work.

**Rotary Sensors** (Figure 23)

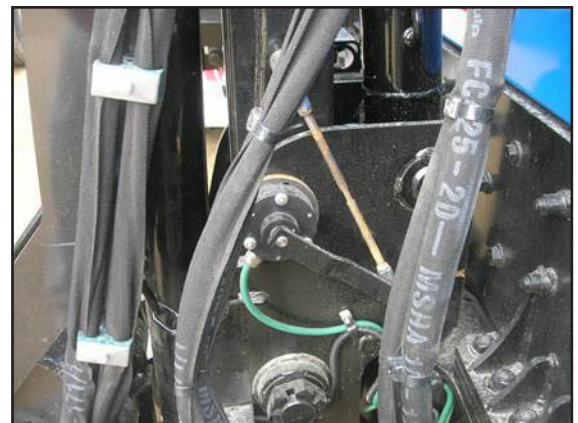
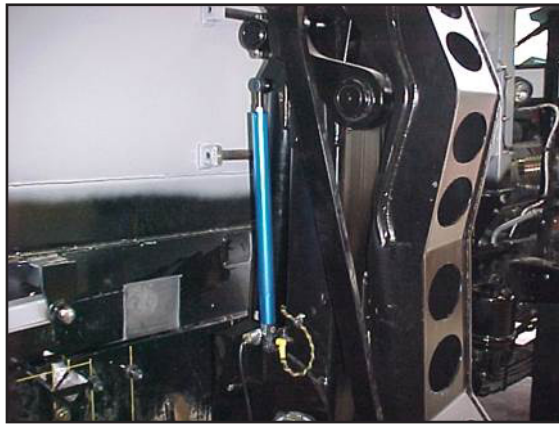


Figure 23



#### 4.4.1.1 Cab Control Box without the Lockout Switch

1. Turn ignition switch ON (see Figure 22).
2. Make sure all E-STOPS are pulled out.
3. Push the pump switch to ON.
4. Turn off battery switch.
5. Simultaneously push and hold the Packer Retract rocker switch and the Auto Pack/Sweep button (do not release until a later step).
6. Turn on battery switch.
7. Wait for the Packer Extend/Retract indicator light to start flashing (this may take 6-7 seconds).
8. Release the Packer Retract rocker switch and the Auto Pack/Sweep button.
9. Step on and hold the foot brake.
10. Close the grabber using the joystick. Ensure the grabber is closed.
11. Extend the arm all the way using the joystick.
12. Retract the arm to the home position using the joystick.
13. Raise the arm into the hopper using the joystick.
14. Lower the arm to the ground using the joystick.
15. Open the grabber using the joystick.
16. Turn off battery switch.
17. Turn on battery switch.
18. Calibration procedure is complete.



#### 4.4.1 Calibration of the Arm Position Sensors

1. On the cab control box (or on the dash controls), confirm the Top Door indicator light and the Tailgate Open indicator light are OFF.
2. Ensure the parking brake or service brake is applied.
3. Engine speed must be below 1000 RPM.

## 4.4.1.2 Cab Control Box with Lockout Switch

For cab control boxes with the Lockout Switch on back of box (Figure 26), follow these procedures.

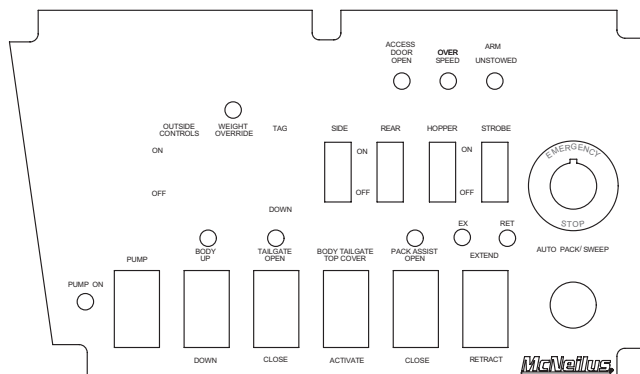


Figure 26

1. Turn ignition switch ON (see Figure 22).
2. Make sure all E-STOPS are pulled out.
3. Push the pump switch to ON.
4. Turn off the Lockout rocker switch on the back of the box.
5. Simultaneously push and hold the Packer Retract switch and the Auto Pack/Sweep button (do not release until a later step).
6. Turn the Lockout rocker switch back to the ON position.
7. Wait for the Packer Retract/Extend indicator light to start flashing (this may take 6-7 seconds).
8. Release the Packer Retract rocker switch and Auto Pack/Sweep button.
9. Step on and hold the foot brake.
10. Close the grabber using the joystick. Ensure the grabber is closed.
11. Extend the arm all the way using the joystick.
12. Retract the arm to the home position using the joystick.
13. Raise the arm into the hopper using the joystick.
14. Lower the arm to the ground using the joystick.
15. Open the grabber using the joystick.
16. Turn the Lockout switch OFF and then ON again.
17. Calibration procedure is complete.

## 5.0 Control Box Outputs

Outputs are sent to operate functions such as lights or MAC air solenoids.

### 5.1 MAC Solenoid Stack

The MAC solenoid stack (Figure 27, Item 1) receives outputs from the control box. The MAC solenoids are used to send air to actuators on hydraulic control valve sections and the joystick.

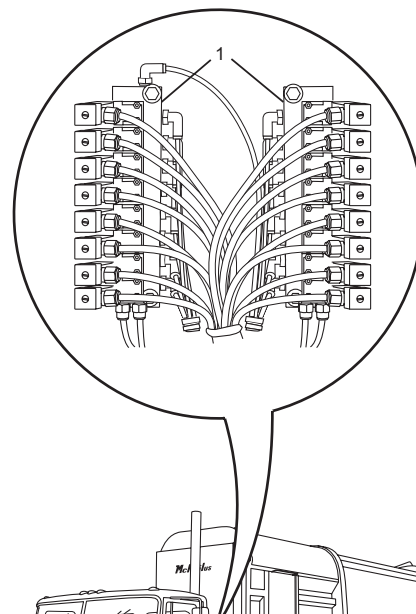


Figure 27

## SAFETY NOTICE

**Air supply must be clean. Contamination of the valve can affect proper operation.**



## 5.1.1 MAC Solenoid Stack Troubleshooting

If a function does not start after you activate it and all 14 power board LEDs are ON, check if the LED is ON at the function's MAC solenoid.

If **MAC solenoid LED is ON**, the problem is not with the control box or wiring to the MAC solenoid stack. Check if the function will operate after you override its MAC solenoid. Using a pen or pencil (Figure 28, Item 1), press the function's MAC solenoid manual button.

### **WARNING**

**When overriding a function using its manual button, be sure to stay clear of the operation of the function. The function may operate when the interlocks are not satisfied.**

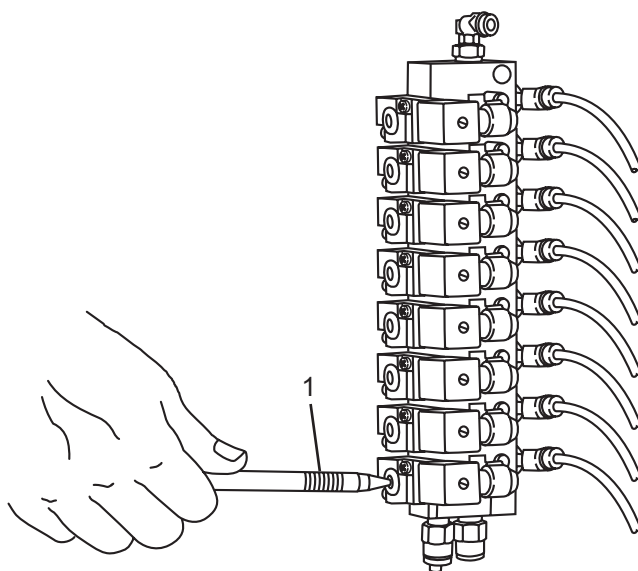
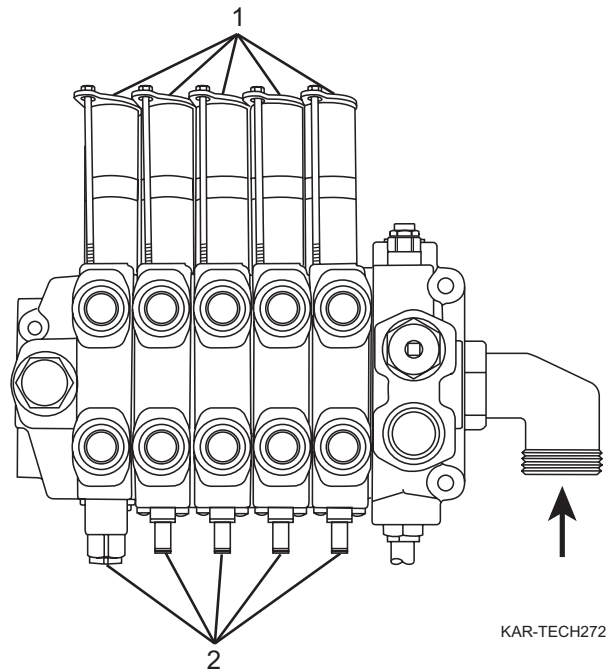


Figure 28

KAR-TECH125

- If the function operates, check the condition of the MAC solenoid.
- If the function does not operate, check for proper operation of the air pressure system and for proper operation of the function's air canister (Figure 29, Item 1). This can be verified by movement on the hydraulic valve section spool (Figure 29, Item 2).



KAR-TECH272

Figure 29

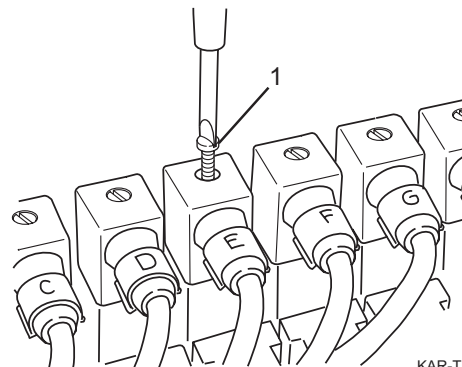
- If the hydraulic section spool moves, the problem is hydraulic related.
- If the valve section spool does not move, check the condition of the air canister or air system.

If **MAC solenoid LED is OFF**, the problem exists with the control box or the wiring to the function.

## 5.1.2 MAC Solenoid Ohmmeter Test

An ohmmeter test of a MAC solenoid and its wiring can be performed using an ohmmeter. The test will determine if the switch and its wiring are in proper operating condition.

1. Disconnect the MAC solenoid stack Deutsch connector from the truck harness. Loosen the screw (Figure 30, Item 1) retaining the DIN connector to the MAC solenoid. Remove the DIN connector.



KAR-TECH271

Figure 30

2. Connect ohmmeter to solenoid pins “1” and “2” (Figure 31). Ohmmeter must indicate between 100 and 300 ohms.

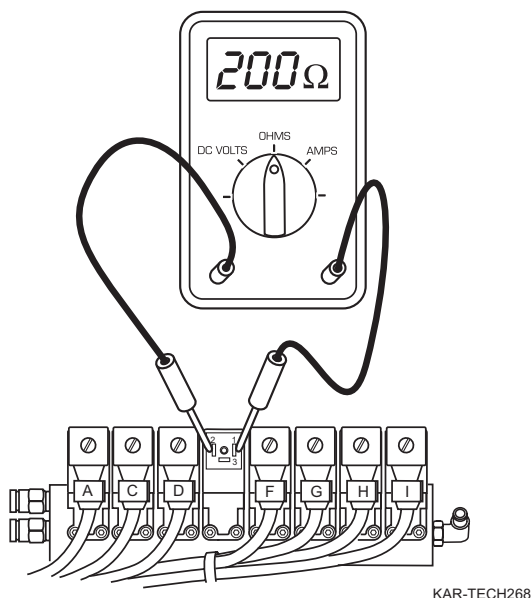


Figure 31

- If the reading is less than 100 ohms, the coil in the solenoid has a direct short. The MAC solenoid must be replaced.
- If the reading is more than 300 ohms, the coil in the solenoid has a partially open condition. The MAC solenoid must be replaced.

## 5.1.3 MAC Solenoid Harness Test

1. Connect the harness to the MAC solenoid.
2. Connect ohmmeter to Deutsch connector pins “B” and the corresponding solenoid’s coil pin (Figure 32).

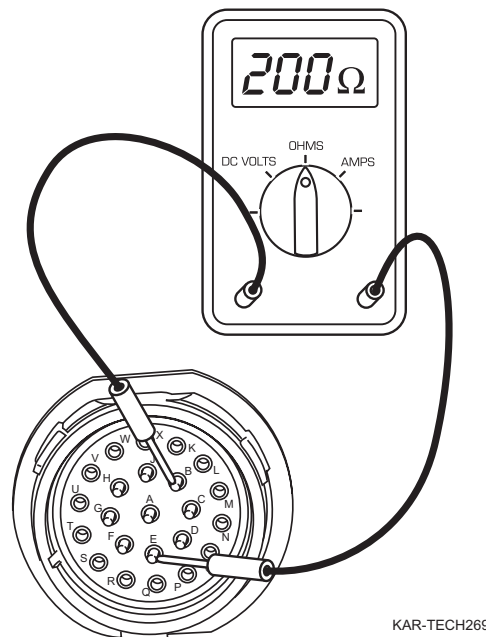


Figure 32

- If the reading is less than 100 ohms, the coil in the solenoid has a direct short. The MAC solenoid must be replaced.
- If the reading is more than 300 ohms, the coil in the solenoid has a partially open condition. The MAC solenoid must be replaced.

## 5.2 Dual-Tone Alarm

The dual-tone alarm (Figure 33, Item 1) is an audible warning activated when the body is up or the tailgate is open.

The alarm also is activated when the truck transmission is shifted into reverse.

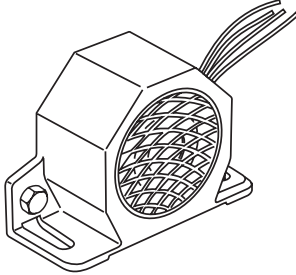


Figure 33

### ⚠ WARNING

Be sure to replace a dual-tone alarm with a dual-tone alarm.

**DO NOT** use a single-tone alarm to replace a dual-tone alarm. Damage to the electrical system could result.

## 5.3 ON/OFF Rocker Switches

ON/OFF rocker switches (Figure 34, Item 1) are used to control optional electrical functions. The switches have lights to indicate when the option is activated.

The ON/OFF rocker switches are 2-position switches. Once pressed, the rocker switch holds its position until the position of the switch is changed.

## 5.4 Momentary Rocker Switch

A momentary switch (Figure 34, Item 2) is used to activate the tag axle option. The switch must be depressed to activate the function. The momentary switch is a 3-position switch. It must be continually pressed to hold its position.

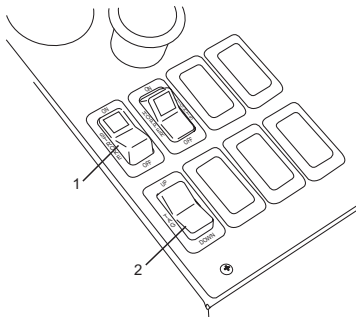


Figure 34

## 5.5 Throttle Advance

The throttle advance (in cab) sends an output signal to the engine ECU (Figure 35, Item 1) to increase engine rpm during operation of refuse vehicle functions.

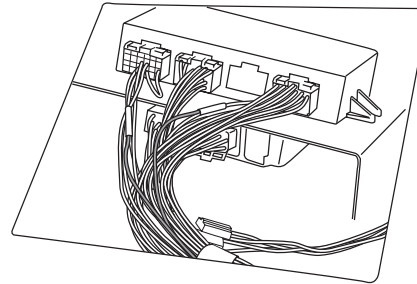


Figure 35

## 6.0 Electrical Connections

### 6.1 Battery Switch

The optional battery switch (Figure 36, Item 1) in the ON position sends 12-volt battery power to the control box. This battery power is the control box's operating power.

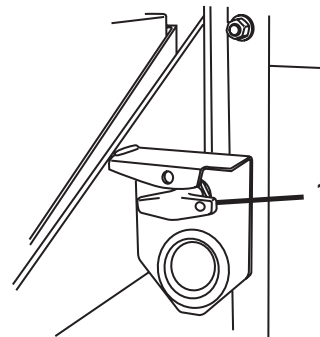


Figure 36

### 6.2 Amp® Connectors

The amp connectors (Figure 37, Item 1) are used at the back of the control box where the connection is not exposed to the environment. They connect the control box to the chassis wiring harness.

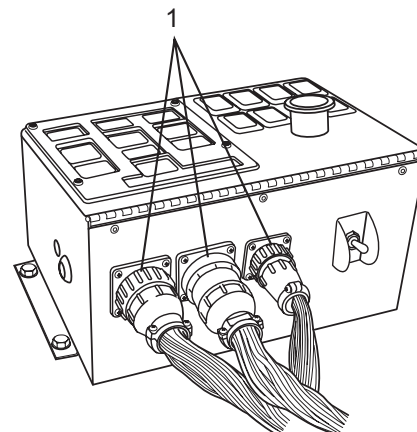


Figure 37

## 6.3 Deutsch® Connectors

Several different Deutsch connectors (Figure 38, Item 1 and Figure 39, Item 1) (typical connector is shown) are used for harness connectors outside of the cab. They provided a reliable connection when exposed to environmental elements. Deutsch connectors are used at major harness junctions and to connect the components to the wiring harness.

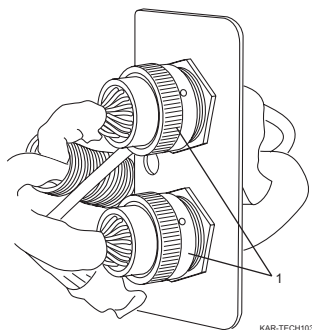


Figure 38

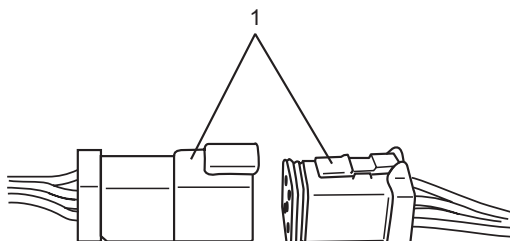


Figure 39

## 6.4 WeatherPack® Connectors

The WeatherPack connectors (Figure 40, Item 1 and Figure 41, Item 1) (typical connector is shown) are used for harness connections outside of the cab. They provide a reliable connection when exposed to environmental elements. WeatherPack connectors are used to connect lights, valves, proximity switches, and other components.

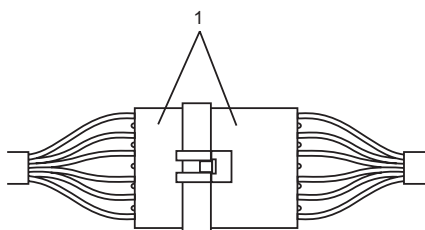


Figure 40

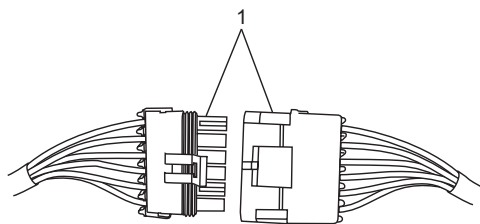


Figure 41

## 7.0 Service Tools

The following are Service Tools required for maintaining the General Electrical system.

### 7.1 Electrical Tools

The following Electrical Tools are required to service the connectors, harnesses, and E-PROM.



*Use only the appropriate pin removal tool for the connector. Using the wrong pin removal tool when servicing connectors will cause damage to the pin and connector.*

#### 7.1.1 WeatherPack Service Kit

McNeilus offers a WeatherPack Service Kit (Figure 42, Item 1), part number 0620080, that contains service connectors, pins, and sockets.

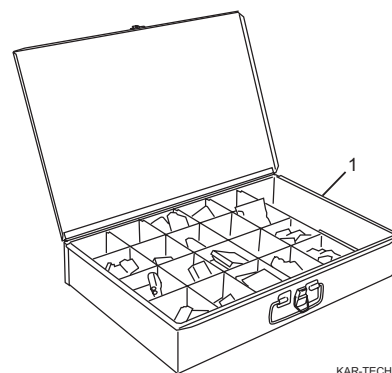


Figure 42

Included in the kit are a Crimping Tool (Figure 43, Item 1) and an Extraction Tool (Figure 43, Item 2).

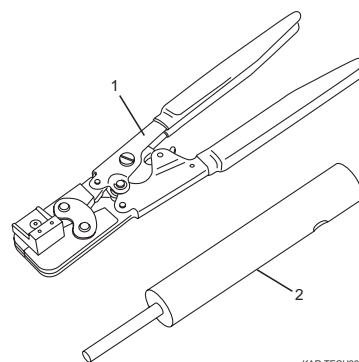


Figure 43

## 7.1.2 Deutsch Service Tools

A crimping tool and several different extraction tools are available from McNeilus to service Deutsch connectors.

The Crimping Tool (Figure 44, Item 1) is part number 0120063. The #16 Extraction Tool (Figure 44, Item 2) is part number 0120062. The #20 Extraction Tool (Figure 44, Item 3) is part number 0120065.

McNeilus offers a Deutsch Service Kit, part number 1107264, which contains the above service tools and service connectors, pins, and sockets.

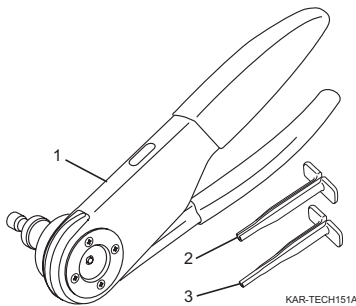


Figure 44

## 7.1.3 Amp Service Tools

A crimping tool and an extraction tool are available from McNeilus to service Amp connectors.

The Crimping Tool (Figure 45, Item 1) is part number 1102797. The Extraction Tool (Figure 45, Item 2) is part number 0120083.

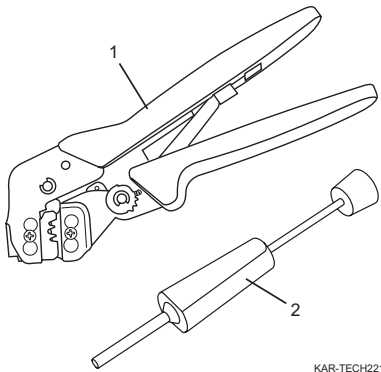


Figure 45

## 7.2 Testers

The following Testers are required to evaluate General Electrical electrical components.

### 7.2.1 Proximity Switch Tester

A Proximity Switch Tester (Figure 46, Item 1), part number 0614503, is available from McNeilus.

The Proximity Switch Tester is used to determine whether a proximity switch is functioning properly. Most proximity testers allow you to connect the switch to the tester and determine the results by pushing a button which will turn on a light for a good switch and no light for a bad switch.

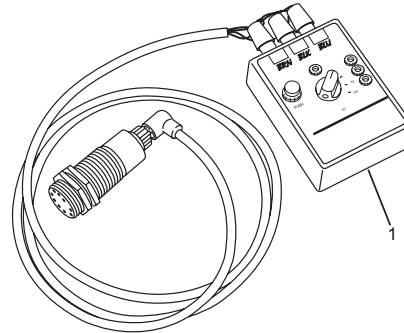


Figure 46

## 7.2.2 Digital Multimeter

A Digital Multimeter (Figure 47, Item 1) must be used to diagnose the electrical circuits on the power board and control board.



*Do not use a test light to check the power board and control board circuitry. The board circuits will be damaged.*

The important thing to remember about multimeters is they will not short out an electronic circuit like a common test light. Electronic signals generally do not use high amperage circuits.

Most electronic boards, including those used in the General Electronic control boxes, use circuits designed to produce amperage levels between 120 and 200 milli-amps. This means they use between 1/8 of an amp and 1/5 if an amp of current on any 12-volt circuit. If you use a standard test light with a probe and ground clamp, you will short the circuit, burn out the board immediately, and not see your light begin to glow. This is true even on fused circuits on solid state boards. Solid state board traces are only able to withstand current flows of 2 amps above the stated fuse capacity in any fuse position.

Multimeters check continuity, voltage and resistance, and provide many other functions depending on the type of multimeter you use.



*Unless otherwise specified, when performing voltage test, connect multimeter ground lead to a clean chassis ground.*



*Do not force multimeter probe into connector sockets. Damage can occur to connector, which could cause improper pin contact and a failure in the circuit.*

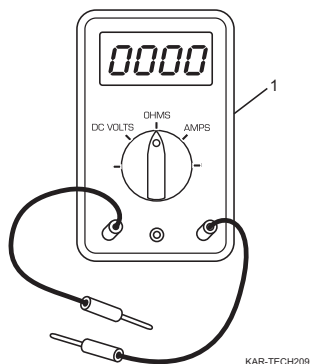


Figure 47

## 7.2.3 Infrared Thermometer

An Infrared Thermometer (Figure 48) is used to detect heat when diagnosing electrical problems caused by resistance and mechanical problems including wheel bearings, U-joints, sticking thermostats, bypassing hydraulic cylinders and collapsed hose liners.

When working with electronics and electrical circuits, resistance will create heat. This means if there is a short or a corroded junction point, amperage will increase and temperature will rise.

This is true even in a braided harness where two wires may have rubbed together creating a short. Simply run the infrared thermometer along the harness until you see a sudden increase in temperature, including a short.

Point the Infrared Thermometer at an object with the button pulled and it will give you the temperature of the object, accurate to the tenth of a degree.

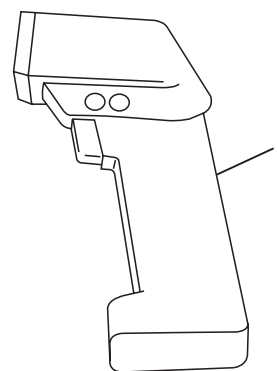


Figure 48

## 7.3 Fuses

### SAFETY NOTICE

**Adding lights or accessories in many cases will overload the circuit and can damage electric or electronic components. Use the appropriate circuit when adding options.**

### 7.3.1 Fuse Replacement

1. Remove the fuse and inspect it. Make sure that the amperage of the fuse matches with the amperage shown for the fuse location on the power board. Replace the fuse with a new fuse of the correct amperage, if necessary.

### CAUTION

**Do not replace a fuse with a higher amperage fuse than is listed for the location. Always use new fuses of the correct amperage.**

**Using a fuse with a higher amperage may cause damage to the equipment.**



2. Verify the circuit functions correctly, and the LED is lighted when the circuit is ON.
3. If the circuit functions properly, the fuse does NOT blow, but the LED remains OFF, replace the power board.
4. If the circuit does not function, the fuse may have blown again, and there is a short or other problem in that circuit.

## 7.3.2 Fuse Amperage Test

If a circuit continues to blow a fuse, check the circuit for excessive amperage.

1. Power up the control box.
2. Remove the fuse.
3. Use an amp meter to measure the amperage across the fuse terminals (Figure 49) on the power board.



*Make sure circuit is activated before checking for amperage across the fuse terminals.*

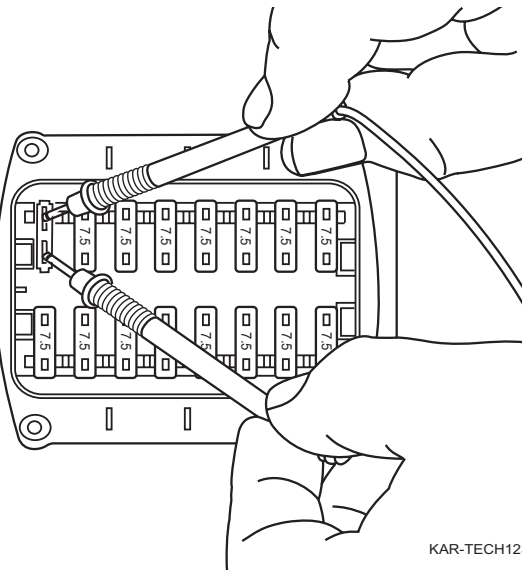


Figure 49

4. If the amp meter indicates amperage equal to or higher than that which the fuse is rated for, the circuit is overloaded. You must review the installation of all components on that circuit to determine what is contributing to the excessive amperage draw.

## 7.4 Relay

The relay (Figure 50) terminals are identified as:

Coil Terminals 85 and 86 - control the relay.

Contact Terminals 30, 87, and 87A - direct power. Terminal 30 is common to both Contacts 87A and 87. Contact Terminal 87A is Normally Closed to Terminal 30. Contact Terminal 87 is Normally Open to Terminal 30.

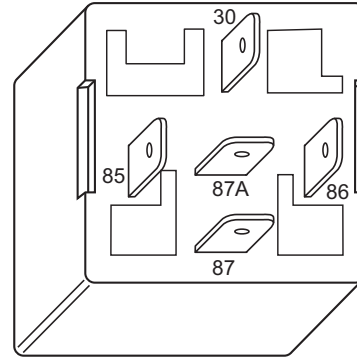


Figure 50

### 7.4.1 Relay Test



*Remove wiring from the relay to protect your ohmmeter when testing.*

1. Continuity test. Connect ohmmeter between terminals 87A and 30 (Figure 51). Ohmmeter must indicate **continuity**.

If ohmmeter does not indicate continuity, replace relay.

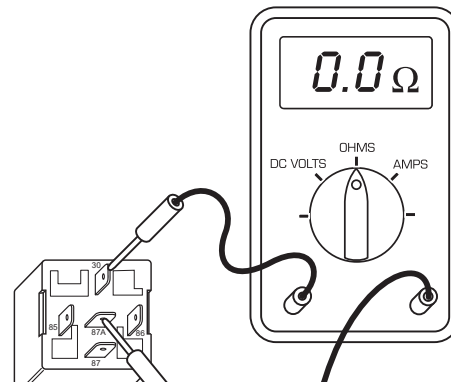


Figure 51



- Continuity test. Connect ohmmeter between terminals 87 and 30 (Figure 52). Ohmmeter must indicate **no continuity**.

If ohmmeter indicates continuity, replace relay.

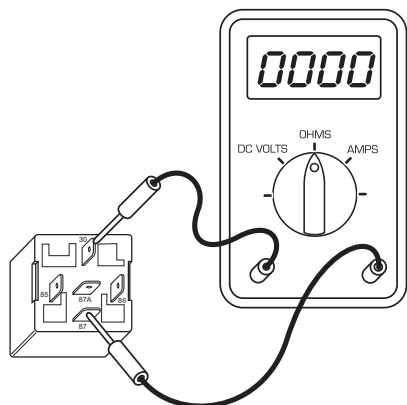


Figure 52

KAR-TECH167

- Ohms test. Connect ohmmeter between terminals 85 and 86 (Figure 53). Ohmmeter must indicate **70-100 ohms**.

If ohmmeter does not indicate 70-100 ohms, replace relay.

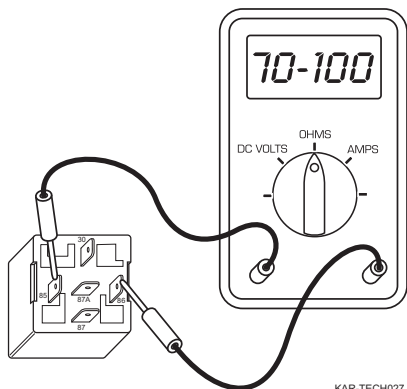


Figure 53

KAR-TECH027

- Continuity test. Connect a 12-volt power source to terminal 86 (Figure 54). Connect a ground source to terminal 85. Connect ohmmeter between terminals 87 and 30. Ohmmeter must indicate **continuity**.

If ohmmeter does not indicate continuity, replace relay.

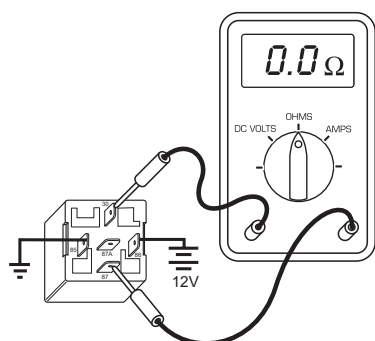


Figure 54

KAR-TECH025

- Continuity test. Leave the 12-volt power and ground sources connected to terminals 85 and 86 (Figure 55). Connect ohmmeter to terminals 87A and 30. Ohmmeter must indicate no continuity.

If ohmmeter indicates continuity, replace relay.

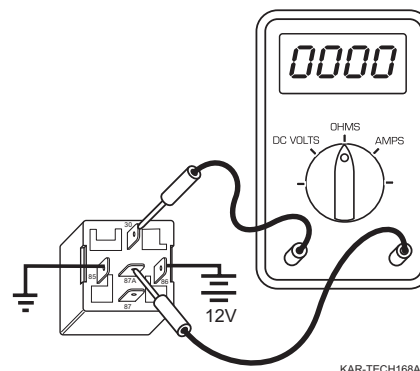


Figure 55

KAR-TECH168A

## 7.5 ON/OFF Rocker Switches

ON/OFF rocker switches (Figure 56, Item 1) use three terminals. The center terminal (Figure 56, Item 2) is input power. The bottom terminal (Figure 56, Item 3) is the ground terminal for the light. The top terminal (Figure 56, Item 4) is the output power for the function and the operating power for the light.

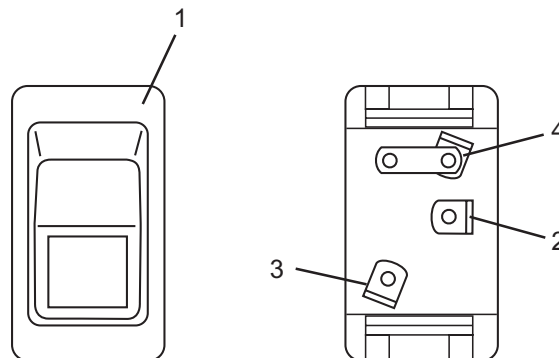


Figure 56

### 7.5.1 ON/OFF Rocker Switch Continuity Test



*Remove wiring from the relay to protect your ohmmeter when testing.*

A continuity test of the rocker switch can be performed using an ohmmeter. A continuity test will determine if the switch is in proper operating condition before installing it into the control box.

- Switch OFF.** Connect the ohmmeter between the rocker switch input power terminal and its output power terminal (Figure 57). Ohmmeter must indicate **no continuity**.

If ohmmeter indicates continuity, replace rocker switch.

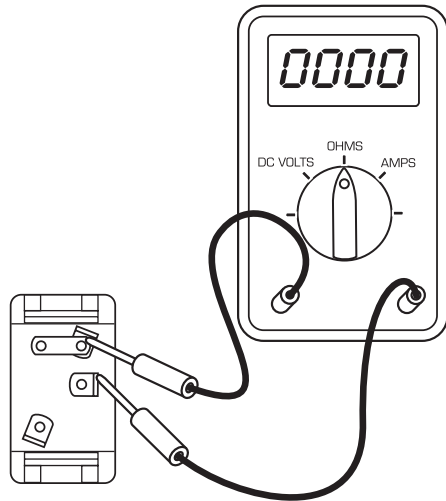


Figure 57

2. **Switch ON.** Connect ohmmeter between rocker switch input power terminal and its output power terminal (Figure 58). Ohmmeter must indicate **continuity**.

If ohmmeter does not indicate continuity, replace rocker switch.

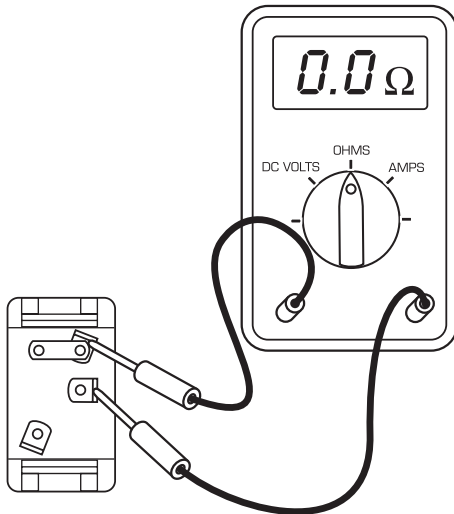


Figure 58

## 7.6 Momentary Rocker Switches

Momentary rocker switches (Figure 59, Item 1) use three terminals. The center terminal (Figure 59, Item 2) is input power. The top terminal (Figure 59, Item 3) and bottom terminal (Figure 59, Item 4) are output power for the function.

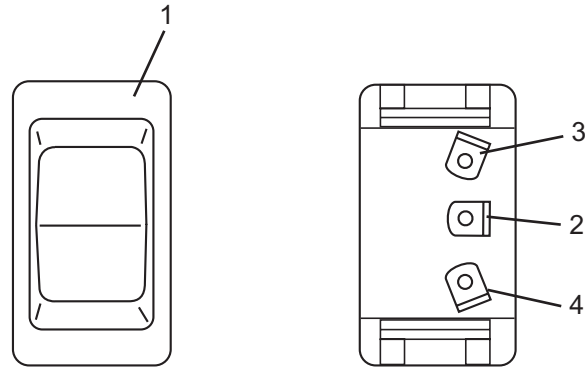
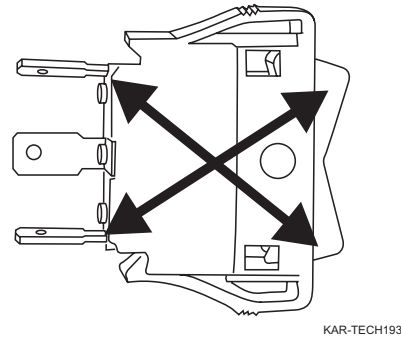


Figure 59

Momentary rocker switches operate in a “cross” pattern (Figure 60). Pressing the top of the switch activates the bottom terminal. Pressing the bottom of the switch activates the top terminal.



KAR-TECH193

Figure 60

## 7.6.1 Momentary Rocker Switch Continuity Test



*Remove wiring from the relay to protect your ohmmeter when testing.*

A continuity test of the momentary rocker switch can be performed using an ohmmeter. A continuity test will determine if the switch is in proper operating condition before installing it into the control box.

1. **Switch OFF.** Connect the ohmmeter between momentary switch input power terminal and its top output power terminal (Figure 61). Ohmmeter must indicate **no continuity**.

If ohmmeter indicates continuity, replace momentary switch.

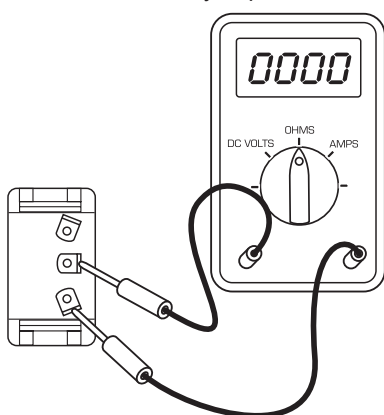


Figure 61

2. **Switch OFF.** Connect ohmmeter between momentary switch input power terminal and its bottom output power terminal (Figure 62). Ohmmeter must indicate **no continuity**.

If ohmmeter indicates continuity, replace momentary switch.

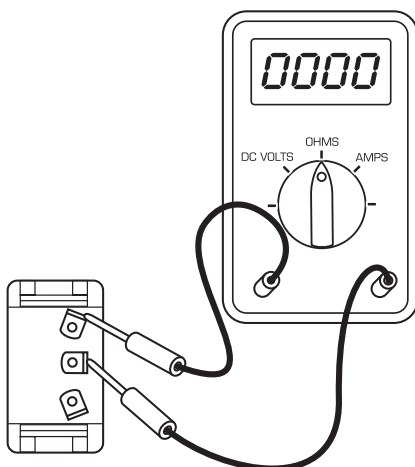


Figure 62

3. **Press bottom switch.** Connect ohmmeter between momentary switch input power terminal and its top output power terminal (Figure 63). Ohmmeter must indicate **continuity**.

If ohmmeter indicates no continuity, replace momentary switch.

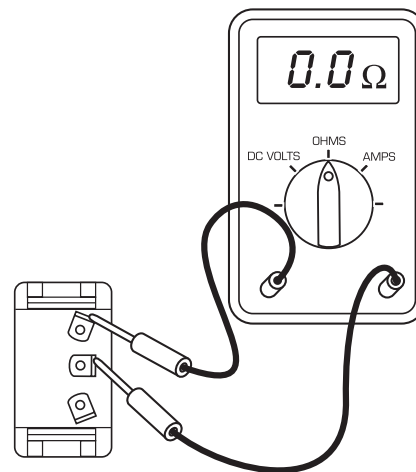


Figure 63

4. **Press top switch.** Connect ohmmeter between momentary switch input power terminal and its bottom output power terminal (Figure 64). Ohmmeter must indicate **continuity**.

If ohmmeter indicates no continuity, replace momentary switch.

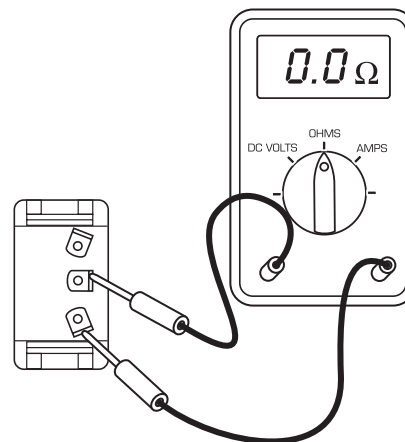
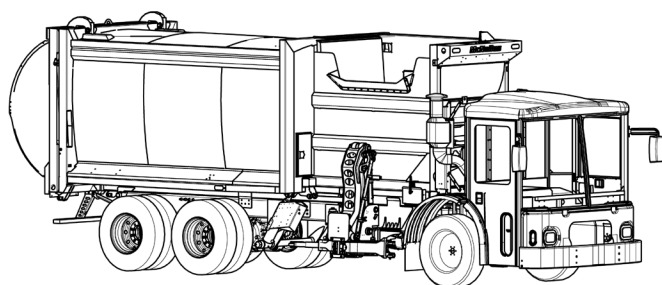


Figure 64

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# Hydraulics

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## 1.0 Hydraulic Oil, Filters, Hoses

The following terms are used to describe hydraulic oil.

### 1.1 Pour Point

This is the lowest temperature at which the oil will flow when it is chilled and undisturbed. The pour point is normally determined under controlled conditions.

### 1.2 SUS

Abbreviation for Saybolt Universal Seconds (sometimes called SSU). It is the way of determining the viscosity of oil at a given temperature. Testing is normally done at 100°F (40°C) and 210°F (100°C).

### 1.3 Centistokes (cSt)

Centistokes is another scale for determining viscosity. Viscosity will frequently be listed both ways. A cross reference chart is available to compare SUS to cSt.

An example:

SUS of 60=10.3 cSt

50 SUS=7.4 cSt.

### 1.4 Viscosity

The viscosity is the resistance to flow or the thickness of the oil normally given as SUS or centistokes. The higher the viscosity, the thicker the oil.

### 1.5 Viscosity Index (VI)

This is the scale showing how the viscosity of an oil will change as the temperature changes. The higher the VI number, the less temperature will affect the viscosity of the oil.

The higher VI numbers are normally achieved by adding small amounts of additives such as viscosity index improvers to the oil.

### 1.6 Viscosity Index Improvers

Viscosity index improvers are usually polymers and will improve the performance of the oil over a wider range of temperatures. Viscosity index improvers are additives used in multiple weight oil such as 10W-30.

### 1.7 ISO Rating

The ISO Rating is a Viscosity Classification System approved by the International Standard Organization (ISO).

### 1.8 Emulsifier

This is an oil additive which allows oil to tolerate a small amount of water by resisting separation and settling.

## 1.9 Hydraulic Oil Requirements

### SAFETY NOTICE

**Automatic Transmission Fluid (ATF) and Motor Oil must not be used in the hydraulic system.**

The lubrication requirements for your McNeilus refuse vehicle are common for hydraulic oils. Hydraulic oils differ from other oils such as ATF or motor oil. Hydraulic oils have additional additives to inhibit wear, rust, oxidation, and foams.

The following is a guideline for the hydraulic oil recommended for the McNeilus refuse vehicles:

Hydraulic Oil Specifications	
ISO Grade	32 Extreme Cold Use (Sub Zero) 46 Normal to Cold Weather Use (Recommended) 68 Normal Use 100 Extreme Heat
API Gravity	32
Viscosity at 210°F	50 SUS
Viscosity Index	100
Pour Point	-25°F to -30°F for Cold Weather

### SAFETY NOTICE

**Cleanliness is extremely important when working with hydraulics. Take every precaution to keep all components clean. Do not let contaminants enter the hydraulic system.**

Most fixed displacement pump manufacturers recommend an oil which as a viscosity of no more than 4000 SUS for cold start conditions (winter) and remains above 70 SUS during normal operating temperatures of 170°F (77°C). It could be necessary to change the viscosity of the oil from winter to summer. The heavier oil will not be able to perform its functions in cooler weather. The proper oil for start up is important as approximately 80% of a pump's wear occurs when the unit is started cold and not yet up to operating temperature. This is why manufacturers recommend the refuse vehicle be warmed up before use.

## 1.10 Hydraulic Oil Change Intervals

Change the oil on a regular basis. Refer to the Preventive Maintenance schedule. The additives in the oil will wear out, shear, break down, and the oil will become contaminated. If the oil is overheated, this process accelerates. All of these factors can greatly increase the wear factor of the hydraulic components. During the first 100 hours, the oil completes the final “clean up” of the hydraulic system by flushing out any particles such as rubber, dirt casting silt, and other normal contaminants in a new hydraulic system.

Hydraulic Oil and Filter Change Interval	
First 100 hours of operation	Change hydraulic oil, suction line filter, and return line filter.
Every month or 200 hours (Whichever comes first)	Inspect the air breather filter, change if required.
Every 6 months or 1250 hours (whichever comes first)	Change hydraulic oil, suction line filter, and return line filter.

Oil does not lose its ability to lubricate but the additives will break down and the oil will become contaminated. With contaminated oil, the wear factor on the hydraulic system increases and dramatically shortens the overall life of your pump, spool valves, and other components. When you drain hot oil by removing the magnetic drain plug on the bottom of the reservoir, you are draining a large percentage of the contaminants from the system. When you put in the new oil, you are replacing the additives in the hydraulic system. The important thing to remember is that cleanliness is required. If you change the oil in a dirty environment, you may be introducing more contaminants into the hydraulic system than you are draining out.

### CAUTION

**Do not drain oil on the ground. Used oils must be carefully collected and disposed of properly as required by law.**

Hydraulic oil that contains a standard hydraulic additive package is recommended for use in McNeilus refuse vehicles. This additive package, which makes up to 20% of your oil volume, normally contains the following additives in varying amounts:

- Anti-Wear
- Anti-Foam
- Anti-Rust
- Anti-Corrosion
- Anti-Oxidant
- Emulsifier
- Detergent (as required)
- Viscosity Index Improvers (Optional)

## 1.11 Hydraulic Oil Temperature

The hydraulic system needs to operate between 150°F to 170°F (66°C to 77°C), measured at the reservoir. This range of temperature is warm enough to eliminate moisture from the system.



*The upper operating temperature range of the hydraulic system is normally determined by the maximum operating limits of the oil. The maximum operating temperature of component seals is 180°F (82°C).*

If operating temperatures are too low, moisture may accumulate in the system. The oil can easily become saturated with moisture.

Hydraulic oil temperatures in excess of 200°F (94°C) for extended periods of time can degrade the additives in the oil, causing damage to the hydraulic system and components.

If you suspect the hydraulic system is overheating, DO NOT attempt to check the oil temperature by touching hydraulic hose, fitting, or pipe. This is not an accurate way to measure heat, and you might get burned. The normal operating temperature of 150°F to 170°F (66°C to 77°C) is hot enough to cause serious burns to the human skin.

### WARNING

**Do not touch or hold hydraulic hoses, pipes, or fittings. Use caution. Hydraulic oil, hoses, fittings, and pipes are hot and can cause serious burns and injury.**

Oil temperatures are normally checked at the reservoir. Heat tape is available which can be taped to the outside of the reservoir. The quickest and probably most accurate way to check oil temperature is with an infra-red heat gun. The infra-red heat gun will allow you to take temperatures at several locations quickly and help determine the source of the heat.

Common sources of excess heat include:

- Oil being forced over relief valves
- Pump inefficiency (in the form of internal slippage)
- Reservoirs which are covered with grease or extremely dirty on the outside
- Low oil levels
- Incorrect oil viscosity (may be oil which has broken down and needs to be changed)
- High pressure drops from plugged filters
- Pinched hoses
- Improper size plumbing
- Incorrect components
- Oil flows which are continuously high

Whatever the source of excess heat, it must be identified and corrected as soon as possible.

## 1.12 Filtering Hydraulic Oil from the Storage Container

Hydraulic oil cleanliness is important to the overall life and performance of the hydraulic system. Contamination is one of the major causes of hydraulic system failure, hydraulic problems, and short hydraulic component life. The manufacturer's OEM filtration system, when serviced according to the manufacturer's recommendations, is adequate to take care of filtration requirements for the vehicle's hydraulic system. However, oil can become contaminated before it is ever installed into the vehicle's hydraulic system.

When hydraulic oil is delivered, it can easily be analyzed for contamination by collecting a sample of the oil from the delivery vehicle or container the oil arrives in. Most companies doing oil analysis can provide clean sample bottles and instructions on obtaining the oil sample.

At the same time, many shops receive clean oil from the supplier and put it into a contaminated storage container in their shops. This storage container may be an oil drum, barrel, or larger storage tank. Any oil storage container will accumulate contamination (including water, which is also a contaminant) over a period of time. The storage container should be periodically flushed and cleaned. Water can be drained from the storage container by installing a petcock in the low area of the storage container bottom and periodically draining off any moisture which accumulates.

Hydraulic oil pumped from the storage container into the hydraulic system should be filtered. These filters should be serviced on a regular basis depending on the amount of oil passing through the filter. Typically, the filter should be changed every six months. Filters, which also trap moisture, are available and will help keep the hydraulic system clean.

## 1.13 Beta Ratings for Hydraulic Oil Filters

Hydraulic oil filters are rated for their filtering efficiency by using an industry standard multi-pass test which is recognized by ISO, ANSI, and NFPA. Test dust of the desired micron size is used for the test. A controlled amount of test dust particles are put into a clean fluid and the fluid is passed through the filter. The amount of test dust particles which exit the filter is counted and an efficiency is established.

Example:

- 1000 dust particles (10 micron) are introduced into the filter
- 500 dust particles exit the filter
- 500 is divided into 1000 and the answer is 2

The filter was 50% efficient and the Beta Rating would be  $B_{10}=2$ .

This system has been in use for a number of years and the filter efficiency is easily calculated.

Another ISO filter efficiency test uses three efficiency valves called X, Y, Z. Particle counts can be determined for many different sizes. X, Y, Z use the following efficiencies:

X = 2 which is 50% efficient (see above formula)

Y = 20 which is 95% efficient

Z = 75 which is 98.7% efficient

This is called a 2/20/75 reporting system and shows the filter's efficiency over a wider range using specific sized test dust particles as required.

## 1.14 Hydraulic Hoses and Pipes

### WARNING

**Do not remove a hydraulic hose or pipe from the hydraulic system until all pressure has been relieved from the hydraulic system. Serious injury could result if these high pressure hoses come apart during use.**

Premium grade hydraulic hoses are installed on your McNeilus refuse vehicle at the factory.

The hydraulic hoses have an SAE rating molded onto the outside covering (lay line) of the hose. Should you have to replace a high pressure hose, it is important to read this SAE rating on the lay line and replace the hose with one of the same or higher pressure rating as originally installed by the factory.

### CAUTION

**Replace damaged hoses, fittings, and pipes before the Packer is returned to service. Should you have to replace a high pressure hose, it is important to read this SAE rating on the lay line and replace the hose with one of the same or higher pressure rating as that originally installed by the factory. Serious injury could result if a hose is installed on the Packer that does not meet the SAE pressure requirement.**

The 2 in. hose which carries the oil from the reservoir to the pump is designed for suction application. It has an SAE rating of 100R4. If this hose requires replacement, it is necessary to install a hose with the SAE 100R4 rating. The incorrect hose may collapse under a suction application.

All hydraulic pipe must meet SAE J1065 specification. This specification coordinates the side wall of the pipe with its diameter with respect to the system operating pressure. The J1065 specification is common for hydraulic pipe and is normally readily available.

Always replace hoses, fittings, and pipes with replacements that have proper, suitable working pressure ratings.

Replacement hoses must be of the correct length and must comply with the hose manufacturer's installation guidelines and recommendations.

Hydraulic hoses have the SAE ratings marked on the hose to assist you in selecting the correct hose.

Any replacement hydraulic hoses and fittings must be supplied by the same manufacturer.

## ⚠ WARNING

**When making replacement hoses for your Packer, it is important to use the same manufacturer for both the hose and the ends installed on the hose. Brand “A” hose may not be compatible with Brand “B” hose ends. Serious injury could result if these high pressure hoses come apart during use.**

## 1.15 Hydraulic Hose Overview

Eaton Aeroquip® brand hoses fall into two basic categories: rubber and Teflon construction. Both categories are available in a variety of pressure ranges.

The low pressure hoses are designed for use at pressures up to 200 psi (13.79 bar), medium pressure hoses for pressures from 200 to 1500 psi (13.79 to 103.42 bar), and high pressure hoses for pressures from 1500 to 3000 psi (103.42 to 206.84 bar).

The low pressure rubber hose has a temperature range from -65°F to +160°F (-53.89°C to +71.11°C). Hose styles in the medium pressure group are rated from a low range of -40°F to +250°F (-40°C to +121.11°C), to a high range of -65°F to +375°F (-53.89°C to +190.55°C). Rubber hoses in the high pressure group are rated from a range of -40°F to 200°F (-40°C to +93.33°C), to a range of -65°F to +375°F (-53.89°C to +190.55°C).

### 1.15.1 Proper Care

The hose and hose assemblies must be properly stored and cared for before being put into service. The hose, whether it is rubber or Teflon type, must not be kinked, collapsed, twisted, or bent sharply. All hose assemblies have a minimum bend radius. This should never be exceeded even while in storage.

Good practice for the rubber hose requires it be stored in dry areas in racks, stock bins or cartons, and free from contamination. Generally, storage should be away from ozone or corrosive atmospheres, and temperatures should not exceed +120°F (48.88°C). The Teflon hose is not restricted to such storage temperatures; storage of this type of hose requires that it be stored generally (with exception of temperature) the same as the rubber hose.

Hoses exceeding established age limits, or showing signs of cracks, separation of plies, or other deterioration should not be installed.

When stored, ends of hose and end fittings should be capped to prevent filtering of dirt and dust into the hose and fittings (Figure 1).

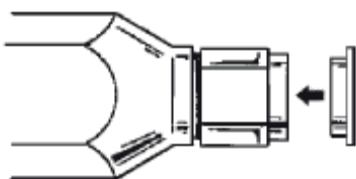


Figure 1

### 1.15.2 Hose Assembly Identification

When replacing a hose assembly be sure to identify it correctly so that the right replacement can be made.

Some rubber hoses have a lay line printed on the cover to provide identifying information. Hoses with stainless steel outer braid are identified with white lettering.

A typical lay line, generally repeated every nine or ten inches along the length of the hose, will usually provide the following information:

1. Mil-Spec, ISO, or SAE specification number
2. Manufacturer's name
3. Part number assigned to style of hose
4. The dash number, or code letter, for size
5. The date of manufacture (quarter of year/year)
6. Hose manufacturer's code

All hose assemblies should have the proper identification showing the part number, cure date of rubber hose, assembly date, and indication that the assembly has been pressure tested (Figure 2).

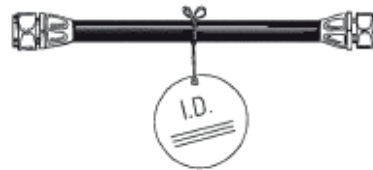


Figure 2

To prevent misapplication, unmarked hose assemblies should not be used unless they can be positively identified.

### 1.15.3 Assembly of Fittings to Hose

If, for some reason, the fittings of the old assembly are not reusable, these will also have to be identified and replaced. Hose length needed can be determined by measuring the old piece of hose or referring to the hose assembly drawing.

Where lubrication is required, care must be taken to use a lubricant that is compatible with the style of hose being assembled.

### 1.15.4 Proper Installation

If the hose assembly that has been removed for replacement shows signs of leakage, corrosion, abrasion, or of having been kinked or twisted, then either the initial installation was improper, or the service conditions were unduly severe.

In most hose assembly applications, it is advisable to restrain, protect, or guide the hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other components or structures. The bend radii must be considered. The bend should be as generous as the installation space will allow, but in no case should it be less than that of the manufacturer's specifications.

Protective devices are available, and are sometimes used, for special installation conditions. These are internal support coils, abrasion sleeves, and various types of clamps with abrasion pads. These all have specific functions and should



be utilized when required.

The use of hose clamps, properly positioned as the installation warrants, is essential. The hose clamp is designed primarily to stand off or separate the hose assembly from adjacent lines, structures, or components, as well as to aid in routing. The clamps should be snug enough to hold or position a line, yet not so tight that they cause a line to be restricted at the point of contact. All hose assemblies should be installed with slight bow or slack to permit both growth and contraction in the line (Figure 3).

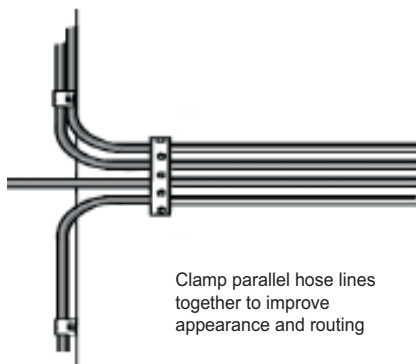


Figure 3

Parallel hose lines may be clamped together to improve appearance and function. Although the hose assemblies are in a sense, operating together, each line is subject to its own impulse surges and other movements. Care must be taken so that relative movements of the assemblies will not cause the securing clamps to rub the sleeve or hose (Figure 4).

A good practice to follow when installing hose assemblies would be to connect the most inaccessible end of the hose, and tighten only finger tight so the hose is free to turn during installation of the opposite fitting. Attach the other fitting in the same manner (Figure 4). Then properly orient the hose assembly along its routing and install the support clamps, making sure to distribute hose slack between the hose clamp and hose fitting connections. The hose clamps would not restrict travel or cause the hose line to be subjected to tension, torsion, compression, or sheer stress during its flexing cycle.

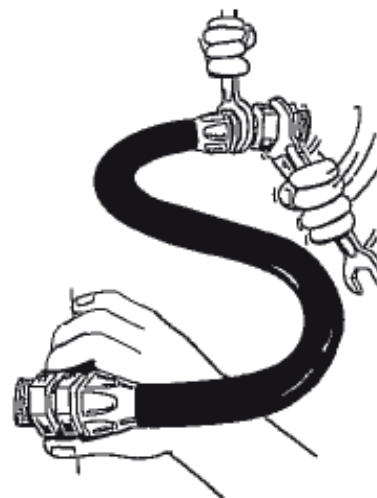


Figure 4

When this procedure has been followed, tighten the end fittings, making sure you do not twist the hose in the process. Use two wrenches, one on the swivel nut and one on the nipple hex.

If these few simple installation procedures are followed, the service life of hose assemblies will be increased and many service problems will be eliminated.

### 1.15.5 Torque Specifications

Always torque hydraulic line fittings to the recommended torque specifications. Failure to do so can cause a part to fail, which may result in serious injury or death. Do not under or over-torque hydraulic lines. Use a calibrated torque wrench. Ensure hydraulic line fittings are properly secured per the torque specification as needed.

See the Torque Standards Section and/or adhere to the torque specifications where provided.

### 1.15.6 In-Service Conditions

When hose assemblies are installed in a system, there are several conditions that need to be considered:

- Safety Factor
- Hydraulic Factor
- Heat Effect
- Corrosion

#### 1.15.6.1 Safety Factor

The burst pressure of a hose assembly is usually four times the rated working pressure. This means the operating pressure to which a hose assembly is subjected should not be less than the rated working pressure. This safety factor may vary sometimes depending upon the type hose being used.

## 1.15.6.2 Hydraulic Shock

Liquid flowing through a closed system is subject to pressure pulses. For example, a hydraulic pump chops the hydraulic fluid into small quantities as it is forced through the system. This action results in the fluid moving in a rippling motion. This must always be taken into consideration, as this rippling motion can shake the system until fatigue failure occurs. Another problem is created every time a valve opens or closes, or an actuator suddenly causes the hydraulic fluid to stop or change direction. This sudden change causes hydraulic shock.

## 1.15.6.3 Heat Effect on the Hose

Heat has an effect on rubber-like materials and tends to harden them, causing a loss of the desirable elasticity in the material. Most rubber hoses are given a temperature range rating, e.g., -40°F to +250°F (-40°C to +121.11°C) or -65°F to +275°F (-53.89°C to +135°C). The upper temperatures are the top limit to which a hose assembly should be exposed when used at, or near, its maximum rated operating pressure. For good hose service life, exposure at or near these temperatures at rated operating pressures should be held to a minimum for best results.

Hose failure under conditions of high temperatures plus high pressure usually takes the form of early leakage at the junction of the hose and fitting. One other condition which will cause severe and rapid hardening of hose inner liner materials is the introduction of air bubbles into the fluids. This is especially true in high temperature oil systems. The entrapped hot air will oxidize and harden the inner liner tube at a rate of two to four times faster than air-free fluids (Figure 5).

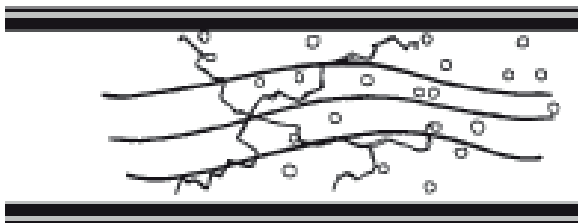


Figure 5

The effect of heat on Teflon hose is completely different from that of rubber hose. Unlike the more common organic rubber compounds, Teflon or "Tetrafluorethylene," as it is more properly known, does not harden when being used at elevated temperatures (-67°F to +400°F) (-55°C to +204.44°C), but stays uniform in texture and consistency.

## 1.15.6.4 Corrosion

The reinforcement in some styles of rubber hose assemblies is carbon steel. These hoses have an outer cover that protects the carbon steel wire braid from corrosion. Damage to the outer cover which permits exposure of the reinforcement to corrosive atmosphere will result in failure of the reinforcement. Hose assemblies with damaged outer covers should be discarded before corrosion leads to hazardous failure.

To avoid the problem of corrosion, Teflon and newer styles of rubber hose with stainless steel braid should be used.

## 2.0 Hydraulic Component Location and Function

### 2.1 Hydraulic Oil Reservoir

Different shape and capacity hydraulic oil reservoirs are used based on the refuse vehicle's needs. The reservoir is normally located on the street side. The AutoReach uses two types of hydraulic reservoirs. A square reservoir (Figure 6, Item 1) can be located on the street side. Depending on the model, it can hold either 40 or 50 gallons of hydraulic oil.

A second type of reservoir is a rectangular reservoir (Figure 7, Item 1) located behind the chassis cab. The capacity is 40 gallons of hydraulic oil.

A breather (Figure 6, Item 2 or Figure 7, Item 2) is provided on top of the reservoir to allow air to pass in and out of the reservoir as the oil flows to and from the cylinders. This breather cap should be inspected every 200 hours. Operating in dusty conditions will require monthly replacement. The change interval may be extended when operating on paved roads. On older units, the filler cap (Figure 6, Item 3 or Figure 7, Item 3) for the reservoir is a sealed pipe cap which can be removed to add oil to the reservoir. Current product uses a vented cap.

The reservoir has two level sight gauges (Figure 6, Item 4 or Figure 7, Item 4) located on either end of it. With all cylinders retracted, the lower sight gauge should be completely filled and hydraulic oil should be slightly visible in the bottom of the upper sight gauge.

A magnetic drain plug (Figure 6, Item 5 or Figure 7, Item 5) is located on the bottom of the reservoir.

Periodically inspect the reservoir and its mounts for damage, rust, and cracks. Clean the inside of the reservoir when servicing the suction line strainer.



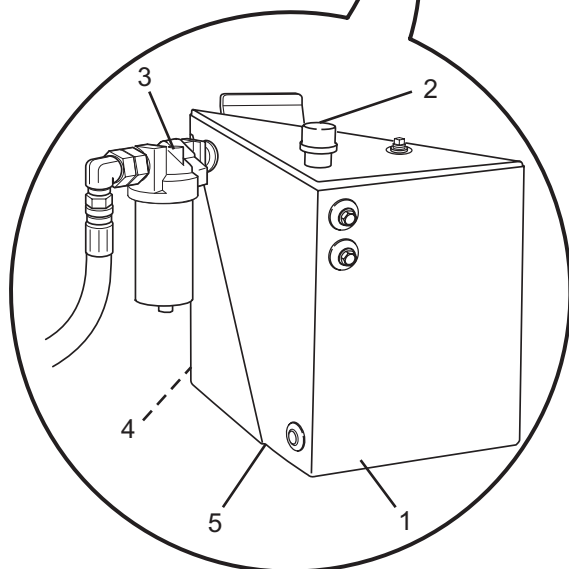
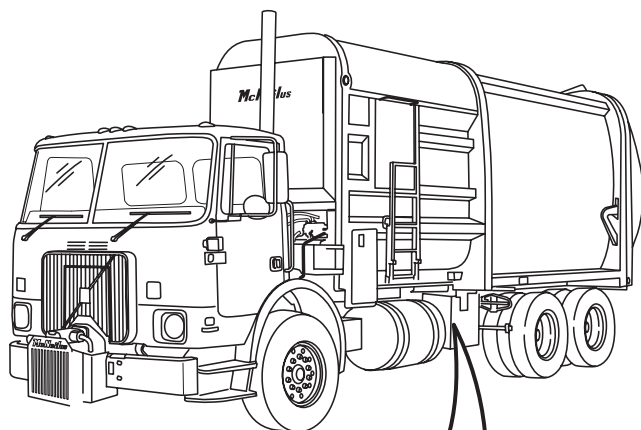


Figure 6

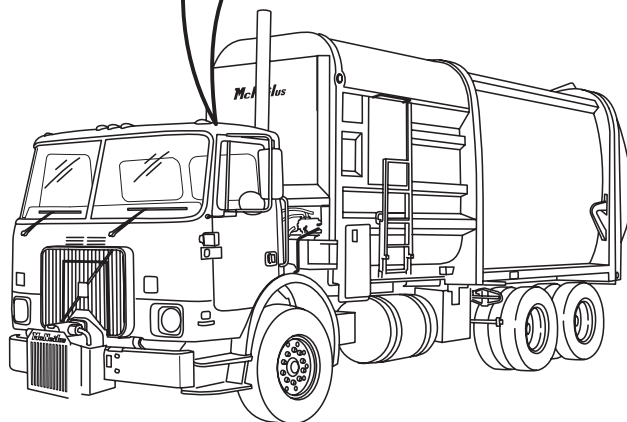
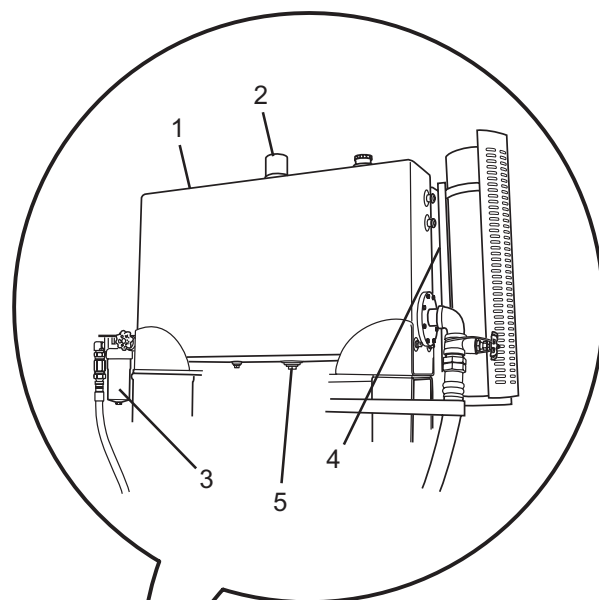


Figure 7

## 2.2 Suction Line Strainer Service

The 100 mesh suction line strainer is located in the bottom of the reservoir. This is a coarse strainer with less restriction than a filter to catch large contamination.

Replace the 100 mesh suction strainer (Figure 8, Item 4) whenever the hydraulic oil is changed.

1. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
2. Remove and retain the eight 1/4 in. grade 8 bolts and washers (Figure 8, Item 1) from the clean-out cap.
3. Carefully remove clean-out cap (Figure 8, Item 2) from the reservoir to avoid damage to the O-ring (Figure 8, Item 3).
4. Unthread the 100 mesh suction strainer (Figure 8, Item 4) from the clean-out cap.
5. Remove the suction baffle.
6. Clean the inside of the reservoir with a lint-free cloth.
7. Replace the O-ring seal if required.
8. Install the suction baffle.
9. Replace the suction strainer (Figure 8, Item 4).
10. Position the clean-out cap (Figure 8, Item 2) on the reservoir.
11. Install and tighten the eight 1/4 in. grade 8 bolts (Figure 8, Item 1).
12. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
13. Tighten all fittings.

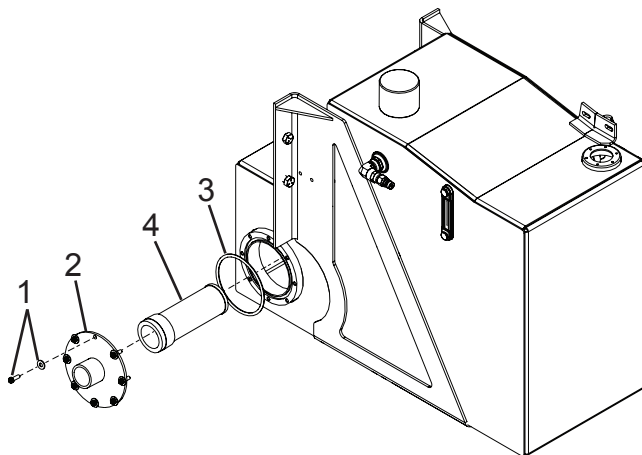


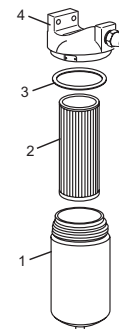
Figure 8

## 2.3 Return Line Filter Service

The hydraulic oil is filtered by a filter mounted in the return line ahead of the reservoir.

Replace the return line filter (Figure 9, Item 2) according to the recommended maintenance intervals for the appropriate model.

1. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
2. Using the proper wrench, turn the filter housing (Figure 9, Item 1) counterclockwise.
3. Dispose of the old element (Figure 9, Item 2) as required by law.
4. Replace the element with a new microglass element.
5. Check the O-ring seal (Figure 9, Item 3) in the filter head (Figure 9, Item 4) and replace if required.
6. Install the element in the filter head.
7. Clean and reinstall the housing.
8. Tighten the housing with the proper wrench.
9. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
10. Tighten all fittings.



HYDRA120

Figure 9

## 2.4 Shut-Off Valve

A 2 in. gate valve is used as the shut-off valve (Figure 10, Item 1). It is located in the suction line between the reservoir and the hydraulic pump.

McNeilus uses a gate valve to minimize restriction on the suction side of the pump.

When the McNeilus refuse vehicle left the factory, the shut-off valve was held open with a tie wrap (Figure 10, Item 1). The tie wrap prevents the gate valve from inadvertently closing.



*Reinstall the tie wrap anytime the shut-off valve is open.*

The shut-off valve must be a full flow valve type so hydraulic flow is not restricted. Any shut-off valves installed in the return line or suction line must be fully open before the refuse vehicle's engine is started. Failure to open the shut-off valves will result in severe damage to the hydraulic system.

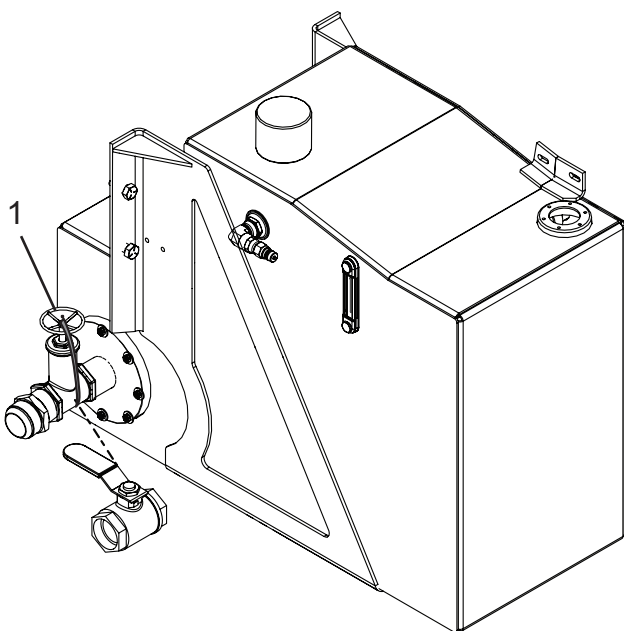


Figure 10

## 2.5 Combo Block

The combo block (Figure 11, Item 1) is located on the outside front wall of the body.

The combo block is an anodized aluminum manifold. It combines various valve cartridges into one location. This simplifies the plumbing and makes a neater package. The combo block is normally mounted close to the valve assembly it serves.

Different configurations of combo blocks are used on AutoReach refuse vehicles.

When the inlet unloader valve is located near the tailgate work section, the HOC normally open (N.O.) valve (Figure

12, Item 4) is located in the combo block. When the inlet unloader valve is located on the hydraulic reservoir, an individual N.O. valve is used.

Each port on the combo block is stamped to help identify the valve. The combo block contains the following valves:

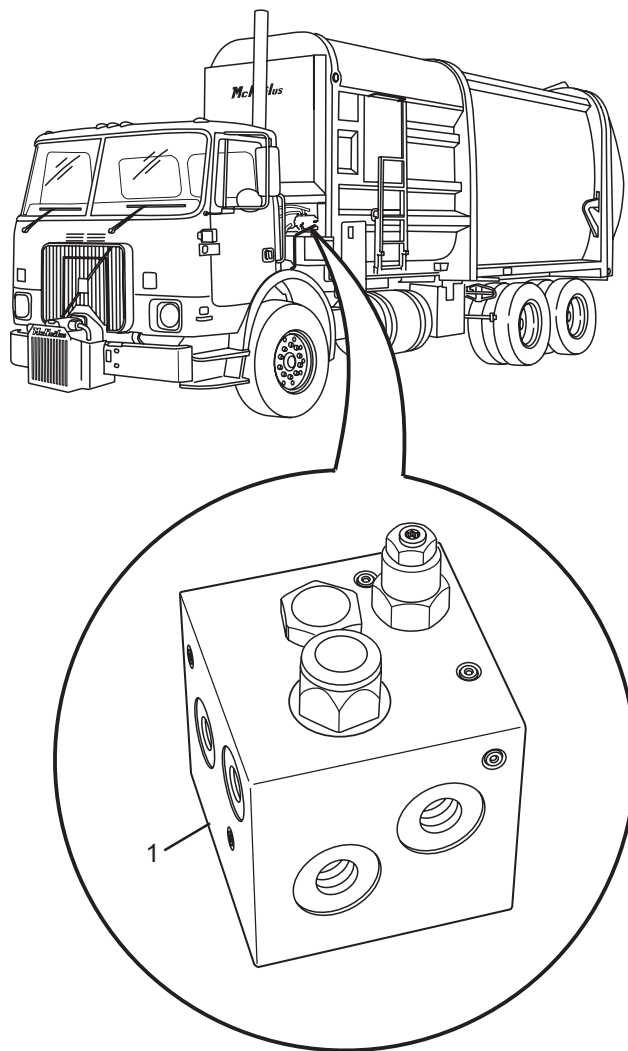


Figure 11

### 2.5.1 Counter-Balance Valve

The counter-balance valve (Figure 12, Item 1) is stamped "CB-TG." This valve traps pressure in the rod end of the tailgate cylinders. The trapped oil holds the tailgate in the CLOSED position.

### 2.5.2 Flow Fuse

The flow fuse (Figure 12, Item 2) is used to prevent spool valve or cylinder leakage from accumulating in the barrel end of the cylinder. The flow fuse allows leakage to drain off to the reservoir.

The tailgate cylinder flow fuse is stamped FF-TG. This prevents the tailgate from opening inadvertently.

## 2.5.3 One-Way Check Valve and Orifice

The one-way check valve and orifice (Figure 12, Item 3) is stamped "CK." The one-way check valve and orifice allows the rod end of the tailgate cylinders to pressurize any time the pressure required by a work function exceeds the pressure in the tailgate cylinder. This maintains a constant down pressure on the tailgate from the cylinders and makes up for normal leakage through the counter-balance valve or cylinders.

## 2.5.4 Normally Open Valve

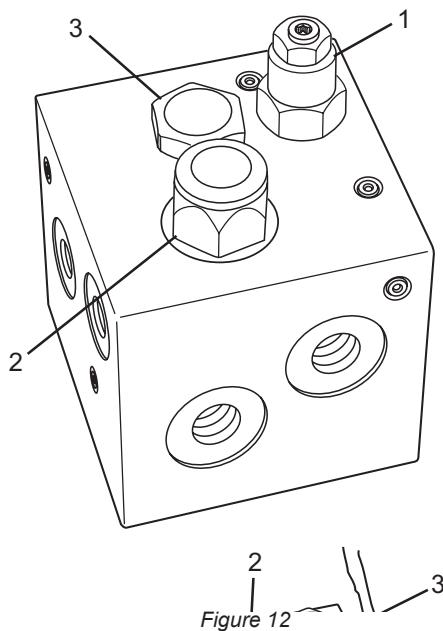
On some previous AutoReach models, the combo block incorporates the N.O. valve (Figure 12, Item 4). The normally open valve is stamped "NO." This valve is used to shift the inlet unloader valve of the HOC system.

## 2.5.5 Combo Block Service

Thoroughly clean the combo block valves with WD-40 or an equivalent product. If the spool in the cartridge needs to be moved or pushed during cleaning, use a soft plastic tool. Using a screwdriver or similar tool may scratch the bore of the cage or damage the spool. Replace the cartridge if the bore or cage is damaged.

Below are the torque specifications for the combo blocks cartridges:

- #7 Cartridge (7/8 in. Hex) - 12 ft.lbs. (16.2 N•m)
- #10 Cartridge (1 in. Hex) - 35 ft.lbs. (47.5 N•m)
- #16 Cartridge (1-1/2 in. Hex) - 65 ft.lbs. (88 N•m)
- #20 Cartridge (1-7/8 in. Hex) - 70 ft.lbs. (95 N•m)
- Solenoid Nuts - 10 in. lbs. (1.1 N•m)



## 2.6 Arm Flow Controls

The arm flow controls (Figure 13, Item 1) adjust the speed of the arm functions. The flow controls used on the AutoReach refuse vehicles are the free-flowing, one direction style. This style of flow control meters oil flow in one direction and provides a free flow in the opposite direction. A schematic is stamped on the side of the flow control showing the direction of flow.

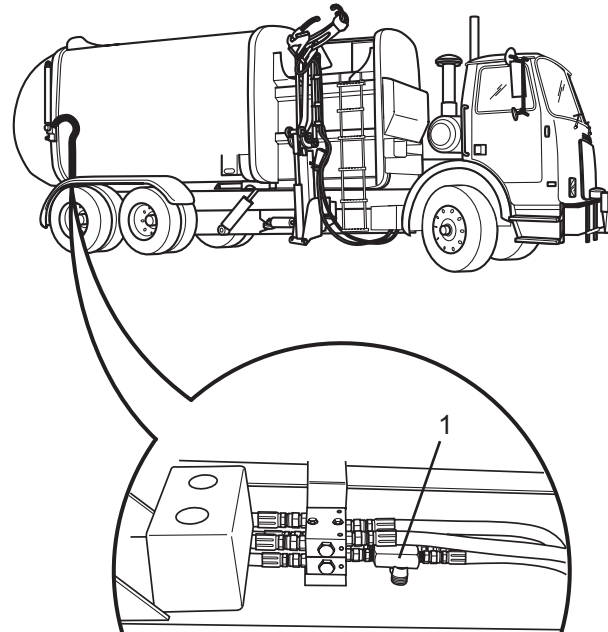


Figure 13

The arm flow controls (Figure 14, Item 1) are used only in the grabber function on current product. On older units, flow controls were used for all arm functions.

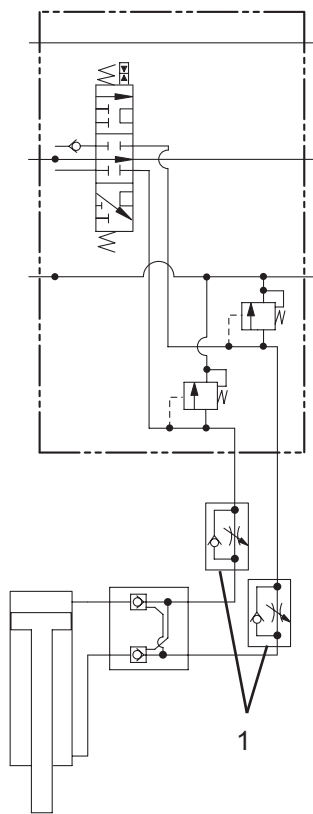


Figure 14

## 2.7 Cross Check Valve

A pilot operated cross check valve (Figure 15, Item 1) is installed for a couple of functions. The valve holds the grabber in place when open or closed. The valve is also used in the Packer Assist Panel function to prevent the panel from drifting down. No adjustments can be made to the cross check valve.

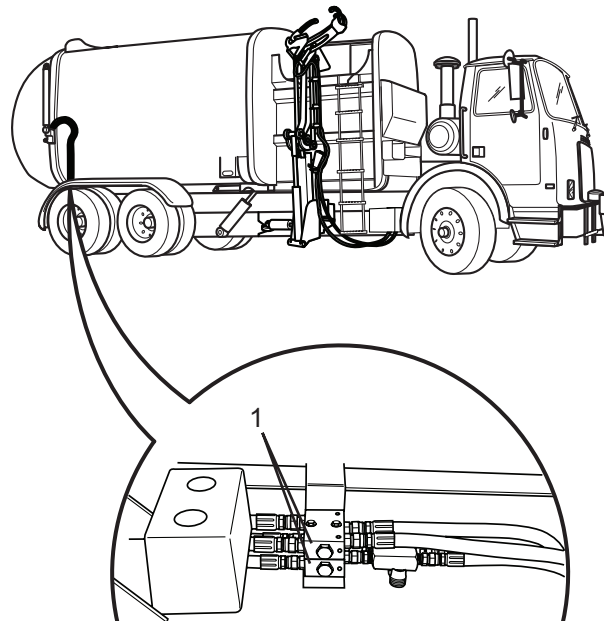


Figure 15

The cross check valve (Figure 16, Item 1) is located between the cylinder and valve section.

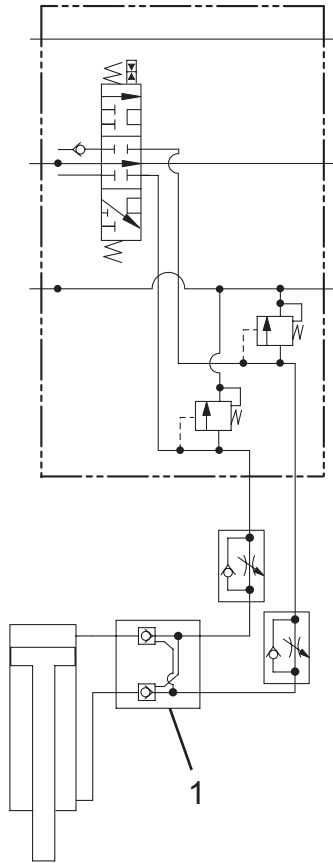


Figure 16

## 2.8 Arm Unloader Block

The arm unloader block (Figure 17, Item 1) is located between the smaller hydraulic pump of a tandem pump assembly, and the arm valve assembly. It is used in place of an inlet unloader valve when a smaller pump with less flow is used. The hydraulic pump used for the arm valve assembly functions is smaller with less flow than the pump used for the packer valve assembly functions. The arm unloader valve either permits the pump flow to route to the VA20 arm valve assembly or to be diverted back to tank. The chassis overspeed signal (generated by the transmission output) is required to energize this valve. If the truck is under 1000 RPM, power is sent to the solenoid. Once the truck exceeds 1000 RPM, power is taken away from the solenoid.

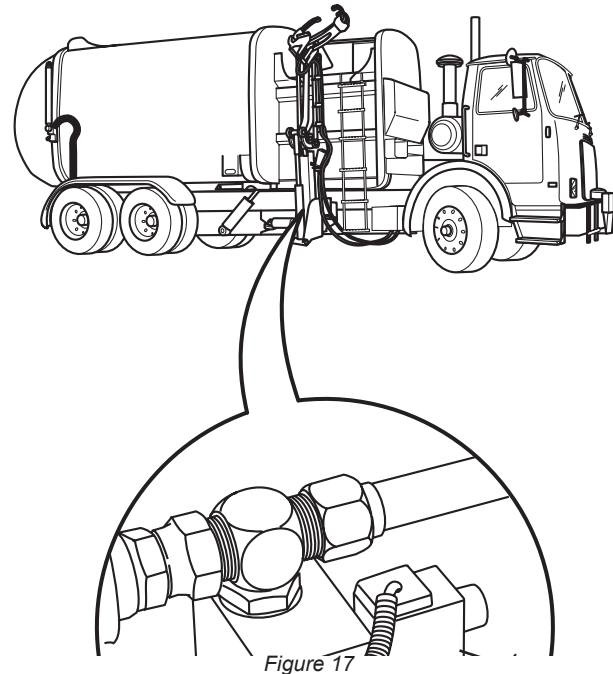


Figure 17

The unloader block (Figure 18, Item 1) directs hydraulic oil to the reservoir (Figure 18, Item 2). The unloader block directs hydraulic oil to the arm valve assembly (Figure 18, Item 3) when the arm pump switch on the control box is ON.

When the arm pump switch is ON, an electrical signal is directed to the normally open (N.O.) valve (Figure 18, Item 4) closing the valve. Hydraulic oil then shifts the logic valve (Figure 18, Item 5) allowing hydraulic oil to flow to the arm valve assembly.

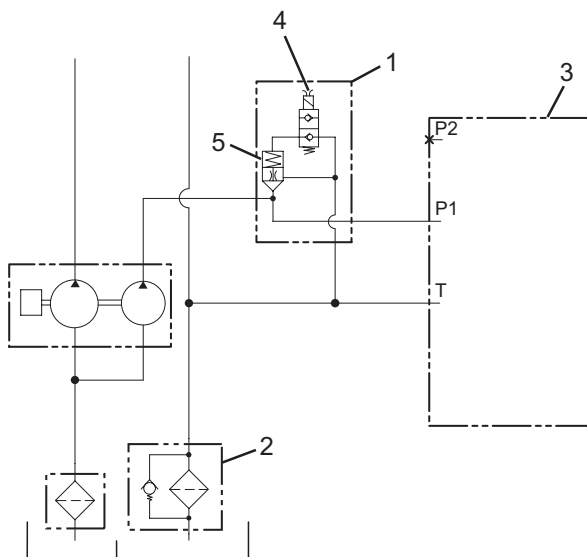


Figure 18

## 3.0 Pump

### ⚠ WARNING

Do not steam clean or pressure wash the pump or hydraulic hose. Cleaning the pump with a high pressure washer or steam cleaning may damage the pump's seals and allow water to enter the hydraulic system. Cleaning the hydraulic hose with a high pressure washer or steam cleaning will damage the hose's outer covering and steel braid and lead to premature failure. The pump and hydraulic hose should be wiped with a clean lint-free cloth rather than washed.

The pump generates the hydraulic flow needed to operate the hydraulic system.

Various models of Parker (Commercial Intertech) hydraulic pumps are used. Displacements of the pump will be coordinated with the PTO or engine application.

The pump receives oil through the inlet port (Figure 19, Item 1). The pump consists of a drive gear (Figure 19, Item 2) and a driven gear (Figure 19, Item 3). A shaft connects

the drive gear to the engine or PTO. When the pump gears turn the direction of the arrows, a vacuum is created on the inlet side of the pump. Oil flows from the inlet side of the pump and around the housing in the gear cavities. As the gears rotate, the oil can not return and is forced toward the outlet port (Figure 19, Item 4).

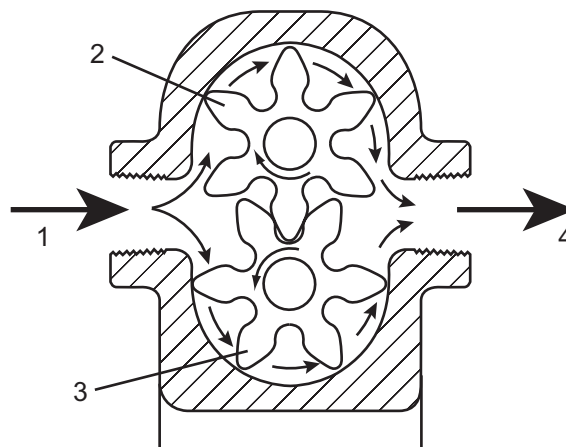


Figure 19

Floating wear plates (Figure 20, Item 1) are on both sides of the gears (Figure 20, Item 2). The wear plates are free to move or "float" on the side of the gears. The wear plates seal against the sides of the gears to make the pump efficient. Without the wear plates, the pump would be inefficient and would not operate under pressure. Depending on pump model, the wear plates can be either 1/4 in. (6.4 mm) or 1/2 in. (12.7 mm) thick.

If a pump is experiencing a 2000 psi requirement, the oil, also under 2000 psi, can flow to the backside of the wear plates and apply forces on the wear plates to hold them tight against the gears. The greater the pressure, the more force on the wear plate.

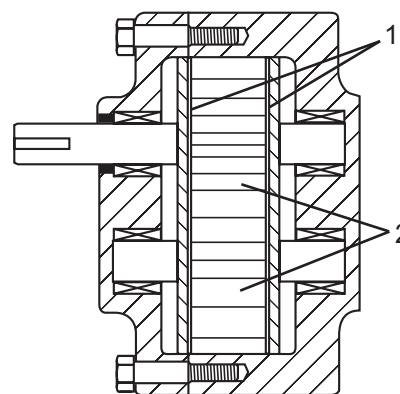


Figure 20



## 3.1 How to Determine Pump Flow

The measurement of the center section of the pump (Figure 21, Item 1) will determine the flow of the pump. To find the flow on a P75 or P76 pump, measure the center section and deduct 1 in. from the measurement. This will arrive at the actual gear width (a 1/2 in. wide floating wear plate is located on each side of the gearset; thus 1 in. must be deducted from the center section measurement). On a P75 or P76 pump, each 1 in. of gear width equals 4.1 cubic inches of displacement per revolution.

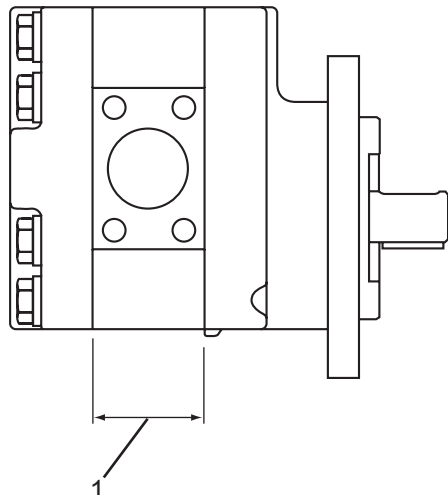


Figure 21

If the gear width equals 2 in., the displacement would equal 4.1 x 2 or 8.2 cubic inches of displacement per revolution. A 1-3/4 in. gear width would equal 1.75 x 4.1 or 7.175 cubic inches of displacement per revolution.

If you take the pump displacement (7.175 cubic inches) and multiply by its rpm, you would know how many cubic inches per minute the pump produces. If you divide the cubic inches per minute by 231 (the number of cubic inches in a gallon), you will know the approximate gallons per minute the pump produces. The P75 or P76 pump is approximately 90% efficient, so multiply the gallons per minute of pump flow by 0.9 for more accuracy.

Example:

7.175 (pump displacement) x 2100 (max rpm) ÷ 231 (cu. in. in a gallon) x 0.9 = 58.7 GPM

A P350 pump has two 1/4 in. wear plates and 2.55 cubic inches of displacement per revolution.

A P365 pump has two 1/4 in. wear plates and 3.6 cubic inches of displacement per revolution.

Use the same formula to determine the flow of the P350 or P365 pump.

The following chart identifies pumps used for common applications.

Mount	Description	Gear Set	Wear Plate
Front	P365	2.50 in.	1/4 in.
Rear PTO	P365	2.50 in.	1/4 in.

## 3.2 How to Determine Hydraulic Horsepower

The formula for hydraulic horsepower is:

$$\text{Hydraulic Horsepower} = \frac{\text{Maximum Power Flow} \times \text{Maximum Pressure}}{1714}$$

If we use the pump flow example from the previous page and use the maximum pressure of the hydraulic system for a specific model, we can determine how much hydraulic horsepower is required by the pump.

For example, the main relief setting for a refuse vehicle is 2700 psi.

$$\text{Hydraulic Horsepower} = 58.7 \text{ GPM} \times 2700 \text{ psi} \div 1714$$

$$\text{Hydraulic Horsepower} = 92.5 \text{ HP}$$



*The pump only produces oil flow. The amount of pressure in the system measured at the pump will be determined by the amount of resistance to the flow, downstream from the pump up to actuator load. The system or pump outlet maximum pressure value is determined by the relief valve setting.*

## 3.3 PL Factor

The PL Factor is used to determine the correct drive line option to meet the pump's hydraulic horsepower requirement. Since the entire input horsepower is fed through a common drive shaft, the power delivered to or from the unit is limited by the physical strength of the shaft. This limit is defined as a "PL" factor; "P" being the maximum pressure and "L" the summation of gear widths.

$$\text{PL} = \text{Maximum Pressure} \times \text{Total Gear Width}$$

Using the pump flow and hydraulic horsepower examples from the previous pages, we can determine what style pump shaft is required.

$$\text{PL} = 2700 \text{ psi} \times 1.75 \text{ in.}$$

The PL factor for the example pump is 4725 (PL = 7425).

The following chart lists the PL factors for various Parker (Commercial Intertech) pumps used by McNeilus. Each style or type of shaft has a unique PL factor.



*PL must not exceed number shown in chart for appropriate shaft.*

## 3.3.1 PL Chart

Shaft Style	Integral Shaft and Gear	Two Piece Style
<b>P51/P52 Pumps</b>		
SAE "B" Spline	6100	6100
SAE "B-B" Spline	9400	•
SAE "B-B" Key	5600	5600
SAE "C" Spline	12900	8500
SAE "C" Key	10900	8500
Connecting Spline	•	8500
<b>P75/P76 Pumps</b>		
SAE "C" Single	8000	8000
SAE "C" Tandem	12500	•
SAE "C" Key	7500	7500
Connecting Shaft	•	10000
<b>P350 Pump</b>		
SAE "B" Spline	6450	4500
SAE "B" Key	4750	4750
SAE "B-B" Spline	9900	9000
SAE "B-B" Key	7100	7100
SAE "C" Spline	19100	9000
SAE "C" Key	13900	9000
Connecting Shaft	•	9000
<b>P365 Pump</b>		
SAE "B" Spline	5050	3500
SAE "B" Key	3700	3700
SAE "B-B" Spline	7750	5350
SAE "B-B" Key	5550	5550
SAE "C" Spline	14900	11950
SAE "C" Key	10800	10800
Connecting Shaft	•	11950

Our examples have used a P75/P76 pump with a 1.75 in. gear width. Using the chart, any of the pump shaft styles would not exceed the PL factor requirement from the chart and would be acceptable.

When calculating for a tandem pump, each section should be regarded as a single unit with corresponding delivery and power input requirements. For tandem pumps, the PL must be calculated for the first connecting shaft as well as the drive shaft.

## 3.4 Pump Shafts

Two types of pump shafts are used. A splined shaft is used when attaching the pump directly to a PTO drive mounted on the chassis transmission. A round shaft with a keyway is used when a drive line is used to drive the pump from the engine crankshaft on the front of the engine.

The most common pump shaft is a SAE "C" Key. The SAE "C" pump shaft is 1-1/4 in. in diameter.

A less commonly used pump shaft is the SAE "B" Spline. The SAE "B" is 7/8 in. in diameter and is most commonly used on Roll-Off models.

## 3.5 Identifying Pump Rotation

Pumps can be assembled for clockwise (CW) (Figure 22, Item 1) or counterclockwise (CCW) (Figure 23, Item 1) operation. The rotation direction is determined by looking at the pump with the drive shaft facing you and the idler gear down.

### 3.5.1 Clockwise Rotation

If the pump has unequal porting:

- the larger port, the inlet port (Figure 22, Item 2), is on the left side of the pump,
- the smaller port, the outlet port (Figure 22, Item 3), is on the right side of the pump
- the idler gear (Figure 22, Item 4) is down, the pump is set up for CW operation.

### 3.5.2 Counterclockwise Rotation

If the pump has unequal porting:

- the larger port, the inlet port (Figure 23, Item 2), is on the right side of the pump,
- the smaller port, the outlet port (Figure 23, Item 3), is on the left side of the pump,
- the idler gear (Figure 23, Item 4) is down, the pump is set up for CCW operation.

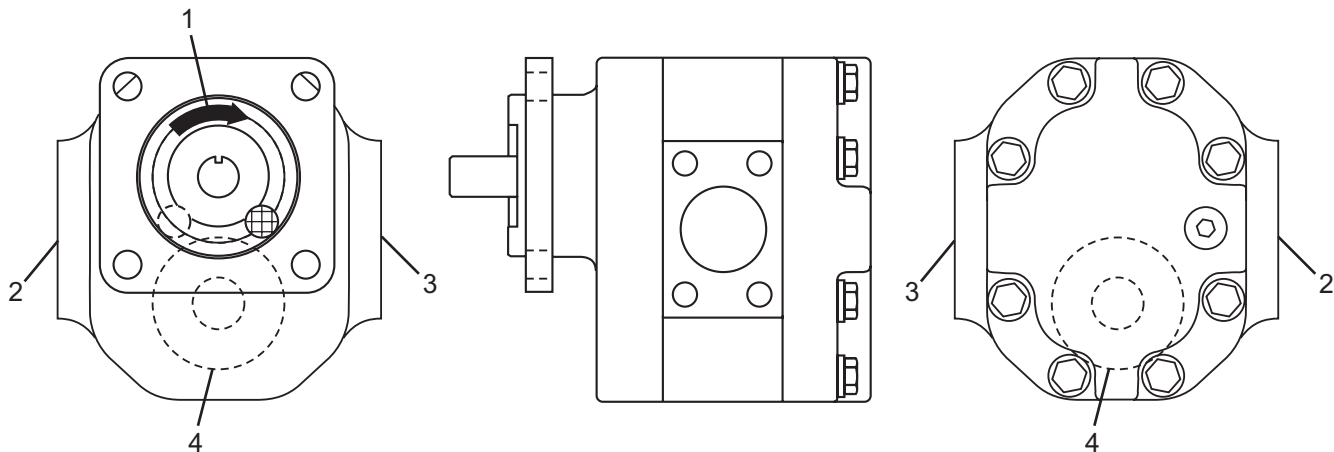


Figure 22

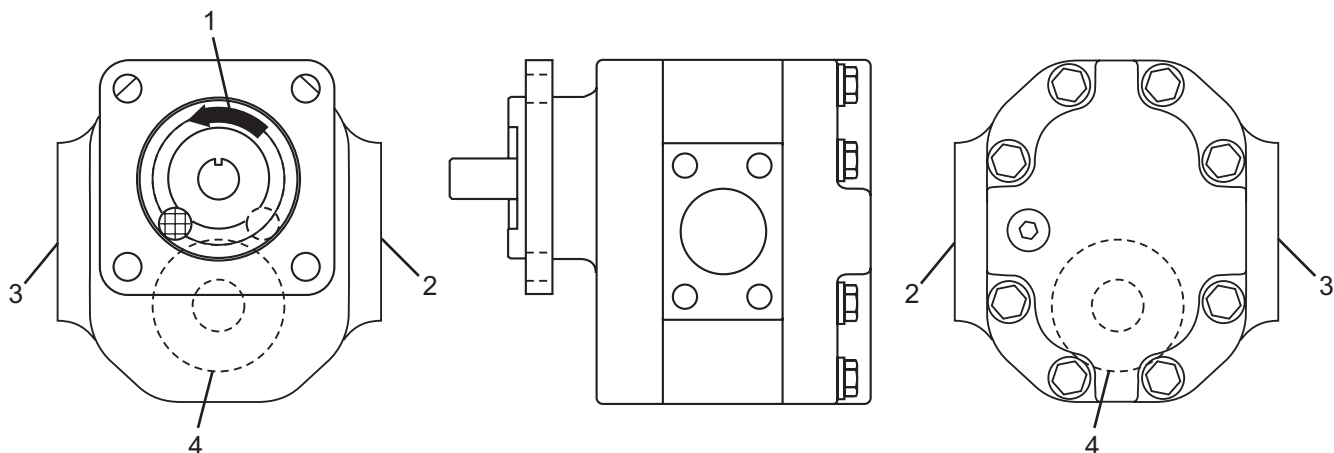


Figure 23

## 3.6 Changing P75/P76 Series Pump Rotation

The P75/P76 series pumps must be disassembled to change the direction of the shaft rotation. Before starting the disassembly process, make sure the pump and work area are clean. Dirt is the natural enemy of any hydraulic system.

The port end cover, gear housings, bearing carrier, and thrust plates must be rotated 180° around the axis of the shaft to accomplish the change of rotation. The shaft end cover and gear sets will remain in their original orientation.

### 3.6.1 Disassembly

#### ⚠ CAUTION

During disassembly, use extreme caution when prying apart castings. The marring of machined surfaces could cause leakage. Excessive use of force can result in misalignment and seriously damage parts.

#### ⚠ CAUTION

Gears are closely matched and must be kept together as a set when removed from the unit. Handle with care to avoid damage to the journals, faces, and teeth.

1. Remove the key if the unit has a keyed shaft.
2. Clamp the unit in a vise with the drive shaft down.
3. Remove the cap screws on single units.
4. Remove the port (rear) end cover.
5. Remove the gear housing and the gear set. The gears are a matched set, so keep them together.
6. Carefully lift the thrust plates off the shaft end and port end covers.

#### ⚠ CAUTION

Do not lose the blue PTFE thrust plate seals fitted in the grooves in the thrust plates.

7. Remove the plug in the shaft end cover with a screwdriver and install it in the opposite drain hole. Screw in tightly and stake the plug with a punch at both edges of the screwdriver slot. For a single rotation pump, the plug (Figure 24, Item 1) is always located on the high pressure (outlet) side (Figure 24, Item 2) of the pump.

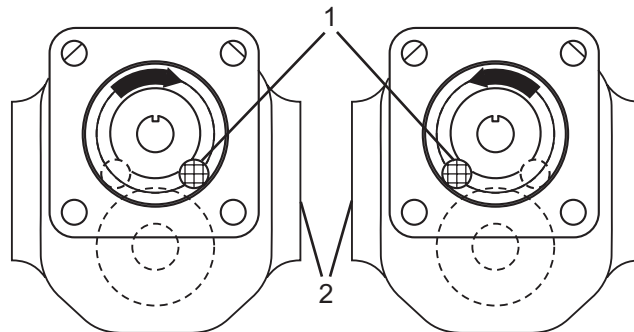


Figure 24

### 3.6.2 Assembly

1. Before assembling the unit, stone off the machined surfaces. This will remove any nicks or burrs that may have resulted from the disassembly.
2. Rinse parts in a cleaning solvent and wipe dry with a clean lint-free cloth.

#### ⚠ CAUTION

P75/76 series thrust plates are designed for single rotation operation and **MUST** be rotated.

3. Place the thrust plates, with the high pressure trapping groove (Figure 25, Item 1) toward the outlet side of the pump, over the shaft end and port end cover bearings. Be sure the blue PTFE thrust plate seals are properly fitted in the seal grooves.

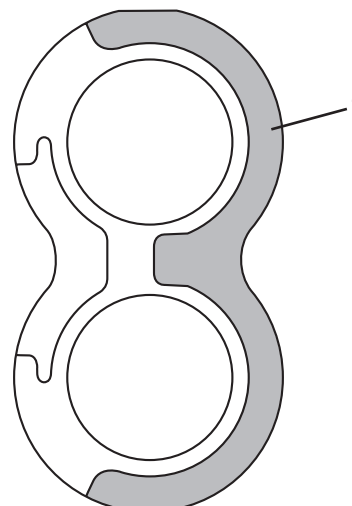


Figure 25

4. Insert the gear shaft with a protective sleeve into the shaft end with a twisting motion. Insert the idler gear.
5. Flip the gear housing 180° (Figure 26) and carefully slide over the gears. Make sure both section seals stay in the seal grooves during assembly. Keep the drive gear and idler gear in the same gear bore as before.

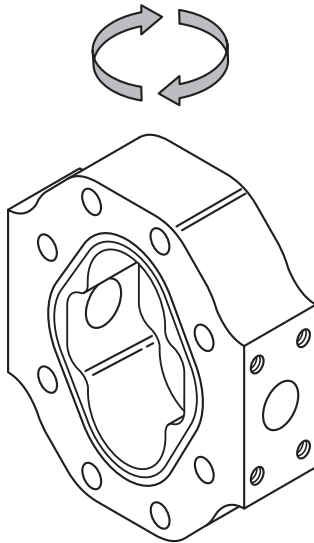


Figure 26

6. Place the port end cover, with the thrust plate, over the gear set. If the port end cover is single ported, a new port end will be required. Be sure the thrust plate is installed with the high pressure trapping groove facing the outlet side of the pump.
7. Insert the cap screws into the unit and torque in a cross corner pattern to 200 ft. lbs. (271 N·m).

## 3.7 Changing P350 Series Pump Rotation

The P350 series pump must be disassembled to change the direction of the shaft rotation. Before starting the disassembly process, make sure the pump and work area are clean. Dirt is the natural enemy of any hydraulic system.

The port end cover, gear housings, bearing carrier, and thrust plates must be rotated 180° around the axis of the shaft to accomplish the change of rotation. The shaft end cover and gear sets will remain in their original orientation.

### 3.7.1 Disassembly

#### ⚠ CAUTION

**During disassembly, use extreme caution when prying apart castings. The marring of machined surfaces could cause leakage. Excessive use of force can result in misalignment and seriously damage parts.**

#### ⚠ CAUTION

**Gears are closely matched and must be kept together as a set when removed from the unit. Handle with care to avoid damage to the journals, faces, and teeth.**

1. Remove the shaft key from the drive shaft. Clean the shaft and inspect for burrs. If burrs exist, lightly stone away to prevent the lip seal from being damaged during disassembly.
2. Place the pump assembly in a vise with the drive shaft pointing downward. Clamp the unit on the sides of the mounting flange. Do not clamp on the round pilot diameter - it could damage the sealing surface.
3. Match-mark and number each casting in the assembly. This will help ensure proper alignment during re-assembly.
4. Use a socket wrench to remove the four hex nuts, washers, and studs.
5. Lift the port end cover. Place the point of a large screwdriver or chisel on the parting line between the port end cover and the gear housing. Lightly tap until a slight separation between the castings is detected.
  - Gently pry the cover away from the gear housing. Be careful not to mar the machined surfaces. Dowel pins will remain in either the port end cover or gear housing. Do not remove them at this time.
6. Remove the thrust plate by hand. Do not pry. The flatness of the thrust plate is critical to pump performance. The channel seals can remain in the thrust plate groove.
  - Inspect the thrust plate for damage and replace the channel seal(s) if the unit has field hours.
7. Match-mark the gear set. Before removing the gear set, wipe the hydraulic oil from the exposed gear faces with a clean, lint-free cloth. Match-mark with machinist's ink or quick-dry marker.
  - Carefully remove the gears from the gear housing. Avoid tapping the gear teeth together or against other hardened surfaces.
  - Carefully remove the second thrust plate by hand from the bearing carrier surface. Keep the channel seal(s) with the thrust plate.
8. Lift the gear housing from the bearing carrier. If prying is necessary, be careful not to mar the machined surfaces. Keep the gasket seals with the gear housing. Replace seals if damaged.
  - The dowel pins will remain in the gearing carrier or gear housing. Do not remove them at this time.

## SAFETY NOTICE

**The cores cast on both sides of the gear bores are not equal size. The larger core must always be on the suction side of the pump to prevent cavitation.**

9. Lift the bearing carrier. If prying is necessary, be careful not to mar the machined surfaces.
  - The dowel pins will remain in the bearing carrier or gear housing. Do not remove them at this time.
10. Remove the third thrust plate by hand. Do not pry. The flatness of the thrust plate is critical. The channel seal(s) can remain in the thrust plate groove.
11. Match-mark the gear set. Before removing the gear set, wipe the hydraulic oil from the exposed gear faces with clean, lint-free cloth. Match-mark with machinist's ink or quick-dry marker.
  - Carefully remove the gears from the gear housing. Avoid tapping the gear teeth together or against other hardened surfaces.
  - Carefully remove the fourth thrust plate by hand from the face of the shaft end cover. Keep the channel seal(s) with the thrust plate.
12. Lift the gear housing from the shaft end cover. If prying is necessary, be careful not to mar the machined surfaces. Keep the gasket seals with the gear housing. Replace seals if damaged.
  - The dowel pins may remain in the shaft end cover or gear housing. Do not remove at this time.
13. Remove the plug from the shaft end cover. Clean the threaded area of the plug.

## SAFETY NOTICE

**Mark the plug hole in the shaft end cover that is without a plug.**

14. Lightly stone the machined casting, where the plug was removed, to eliminate burrs. Clean the shaft end cover. Inspect the shaft lip seal for damage and replace if wear or nicks are visible.

### 3.7.2 Assembly

1. Stake the plug with a prick punch at both ends of the screwdriver slot and around the edges. Peen the edge of the hole 1/16 in. to 1/32 in. (0.8 mm to 1.6 mm) with a 1-1/2 in. (38 mm) diameter steel ball.
2. Inspect the gasket seals for damage. Insert them into the grooves on both sides of the housing. Rotate the gear housing 180° from its original position. Place the gear housing over the shaft end cover. The large inlet core is now opposite its original position. Make sure the gasket seals are in the grooves and do not pinch them during assembly.
  - It may be necessary to reposition the dowel pins.
  - Lightly tap the gear housing with a soft hammer until

it rests against the shaft.

3. Gently slip the thrust plate into the housing bore with the channel seal toward the shaft end cover.
  - Make sure the channel seal is properly seated in the groove with the flat side of the seal facing away from the thrust plate. The high pressure relief groove (Figure 27, Item 1) in the plate must face the outlet side of the pump.

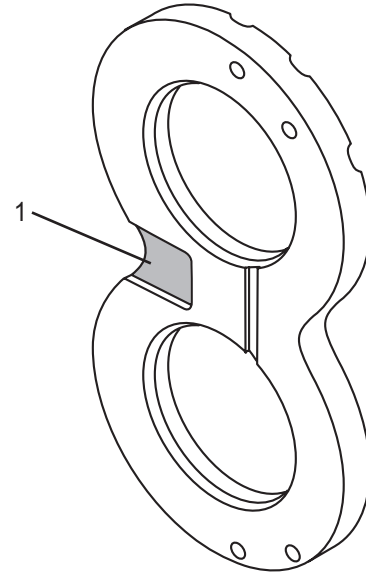


Figure 27

4. Slide the driven gear through the gear housing and into the bushing.
  - Lightly grease the drive shaft and slide through the housing into the bushing in the shaft end cover. Match the gear with the driven gear as previously match-marked. Push through the bushing and shaft seal with a gentle, twisting motion.
  - Apply clean, hydraulic oil over the gears.
5. Mark the position of one of the tooth points on the outside of the gear housing. This will be used for a reference during the installation of the second gear set.
6. Slip the thrust plate with seal(s) over the gear journal and into the gear housing.
  - Make sure the channel seal is properly seated in the seal groove with the flat side of the seal facing away from the thrust plate. The channel seal groove (Figure 28, Item 1) in the plate must face the outlet side of the pump.



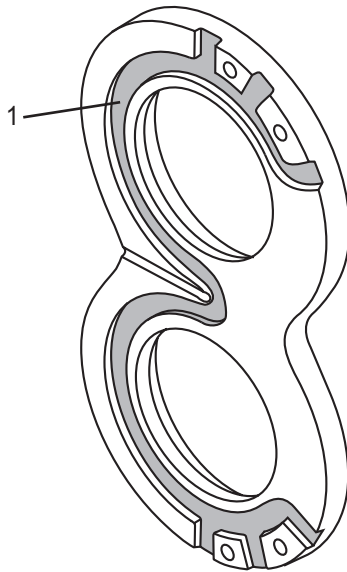


Figure 28

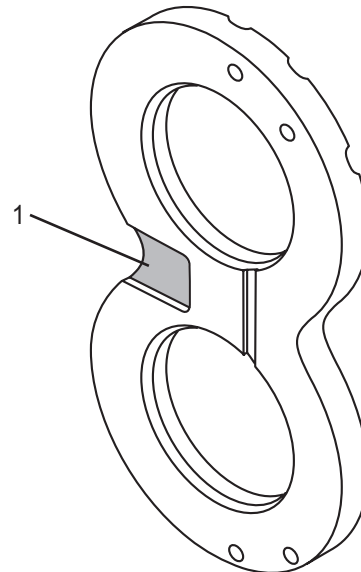


Figure 29

7. From its original position, rotate the bearing carrier 180° around the shaft axis, and position over the gear housing and gear journals. The test ports will now be on the bell of the pump instead of the top.

## SAFETY NOTICE

**Do not flip the bearing carrier 180°, front to back. The internal coring will dead block flow from the front section causing immediate failure.**

- Lightly tap the bearing carrier with a soft hammer, until it rests against the gear housing.
8. Inspect the gasket seals for damage. Insert them into the grooves on both sides of the housing. Rotate the gear housing 180° from its original position. Place the gear housing over the shaft end cover. The large inlet core is now opposite its original position. Make sure the gasket seals are in the grooves; do not pinch during assembly.
    - It may be necessary to reposition the dowel pins.
    - Lightly tap the gear housing with a soft hammer until it rests against the shaft end cover.
  9. Gently slip the thrust plate into the housing bore with the channel seal toward the shaft end cover.

Make sure the channel seal is properly seated in the seal groove, facing the flat side of the seal away from the thrust plate. The high pressure relief groove (Figure 29, Item 1) in the plate must face the outlet side of the pump.

10. Insert the connecting shaft into the female-splined drive gear.
11. Slide the driven gear through the gear housing and into the bushing.
  - Next, insert the drive gear, matching the gear with the driven gear as previously match-marked.
  - Before engaging with the connecting shaft, rotate the gear set so the tooth position is one half a tooth space from the reference mark on the front gear housing. This will put the gears “out-of-phase” and maximize performance.
  - Apply clean, hydraulic oil over the gears.
12. Slip the thrust plate, with seal(s) over the gear journal and into gear housing.
  - Make sure the channel seal(s) is properly seated in the seal groove, facing the flat side of the seal away from the thrust plate. The channel seal groove in the plate must face the outlet side of the pump.
13. From its original position, rotate the port end cover 180° around the shaft axis, and position over the gear housing and gear journals.
  - It may be necessary to reposition the dowel pins.
  - Lightly tap the port end cover in the center (between the bearing bores) with a soft hammer until it rests against the gear housing.
14. Thread the studs into the shaft end cover. Place washers and nuts on that studs and tighten alternately, or cross pattern. Rotate the drive shaft with a 6 in. wrench to check for binding. If there is no internal binding, torque diagonally opposed fasteners to 200 ft.-lbs. (271 N•m).



## 3.8 Pump Drive Line Installation

A yoke is mounted on the input shaft of the pump. This yoke is held in place by a set screw. Should the yoke be removed or replaced for any reason, it is important to place a drop of Blue Loctite® on the set screw to hold it in place, and wire tied in position after it is installed. Before installing a pump, apply Never Seize® on the splines to prevent the pump from being locked on the spline.

## 4.0 Spool Valves

Spool valves can be activated manually with handles, pneumatically with air canisters or electricity.

Two common Parker (Commercial Intertech) spool valve sizes are used.

- VA20 - rated 40 GPM
- VA35 - rated at 70 GPM

The spool valves have a natural leakage factor. This leakage is the oil movement along the clearance between the spool and its bore. The oil film has to be maintained in this clearance to allow the oil to be clean, to lubricate, and to cool. The warmer the oil, and the higher the pressure, the more leakage there will be. The maximum normal leakage from a spool valve port is 30 cc per minute at 120°F (49°C). This leakage could affect the function that the spool valve operates and must be dealt with when necessary.

Most McNeilus applications are an “open center” spool valve assembly. Open center spool valves allow a continuous oil flow through the center of the valve when no functions are being operated.

All spool valve assemblies have an inlet section, one or more work sections and an outlet section. These sections are held together by four tie rod bolts. Seals are installed between the sections to seal the assembly.

Before disassembling a spool valve assembly, mark each section in sequence with a waterproof, quick-drying marker. Start with the inlet section.

Remove the tie rod bolts (Figure 30, Item 1). On VA series sections, the tie rod bolts thread into the outlet casting. Disassemble the sections and discard all sections seals.

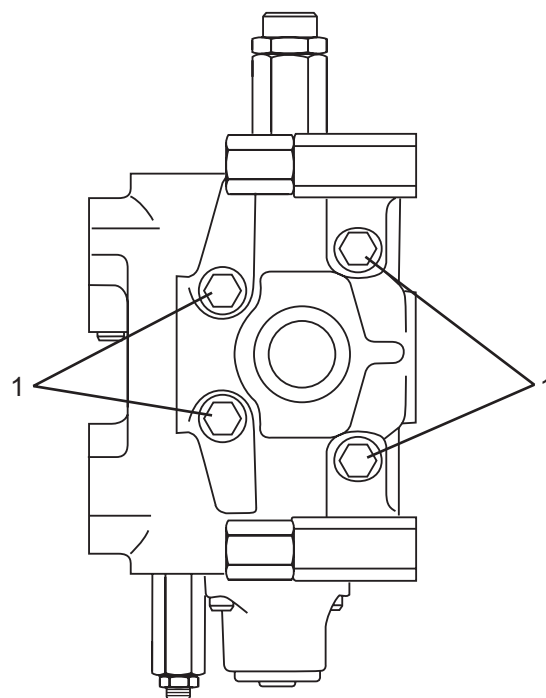


Figure 30

Before assembling, apply grease to new section seals and install them on the downstream mating face of each section. Place the sections on the tie rod bolts in their proper sequence. Tighten the tie rod bolts in a cross pattern to a torque of:

- VA20 - 29 ft.-lbs. (39.3 N•m)
- VA35 - 34 ft.-lbs. (47.5 N•m)

The body valve assembly on an AutoReach requires a special torque on the tie rod bolts. The tie rod bolt torque is 52 ft.-lbs. (72.6 N•m)

## 4.1 Inlet Sections

Three types of inlet sections are available for the VA35 spool valve. The VA35 can use a standard inlet section, an inlet unloader section or an inlet section with relief. An inlet unloader section is required for the HOC system. The inlet unloader section is available only on a VA35 series spool valve.

### 4.1.1 Inlet Unloader Section

The inlet unloader section is always installed in the first valve assembly. The inlet unloader sections contains the unloader valve and the main relief valve. The unloader valve determines whether the oil will be forced to flow through the spool valve or given the option of returning to the reservoir.



*The main relief valve will determine the maximum operating pressure of the hydraulic system.*

## 4.1.1.1 Inlet Section with Relief

The inlet section with relief contains a main relief valve.

## 4.1.1.2 Standard Inlet Section

The standard inlet section does not contain an unloader valve or a main relief valve.

## 4.2 Work Sections

Three types of work section are used.

### 4.2.1 Parallel Work Section

The parallel section (Figure 31) is the most common type of work section. This section shares oil with downstream functions through the open center of the valve assembly. However, oil will always flow to the easiest function. As an example, if two parallel work sections, installed side-by-side, are activated at the same time, the section with the easiest function will use as much oil as possible to operate that function before the other function can have any oil. The other function may not operate until the easiest function is completed.

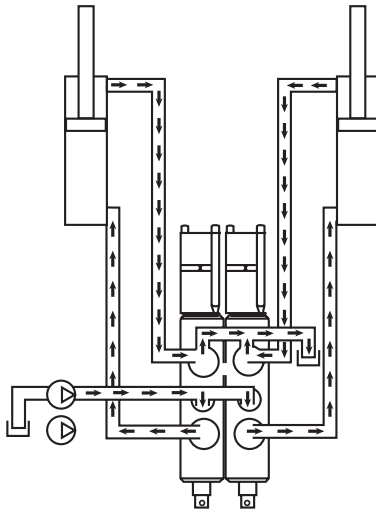


Figure 31

### 4.2.2 Series Work Section

The second type of work section is a series section (Figure 32). The series section will not share oil with downstream functions via the open center, but will allow return flow from the function the series section is operating to feed the downstream sections. As an example, if a series work section is extending a cylinder, the return flow from the opposite end of the cylinder will be returned to the open center.

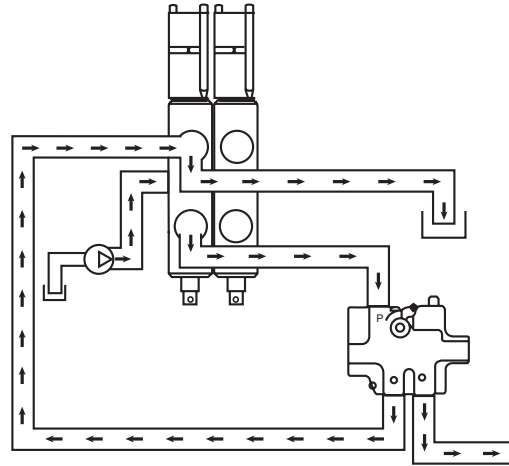


Figure 32

### 4.2.3 Tandem Work Section

The third type of work section is a tandem section (Figure 33). This section shares no oil with downstream functions. Return flow, from the function the tandem work section is operating, returns directly to the reservoir.

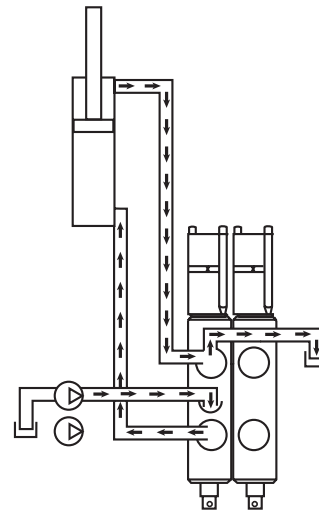


Figure 33

## 4.3 Work Section Configuration

Two work section configurations are used:

### 4.3.1 Hi-boy Work Section

A hi-boy work section (Figure 34, Item 1) is simply higher. It is used if workport relief valves (Figure 34, Item 2) or similar devices are required.

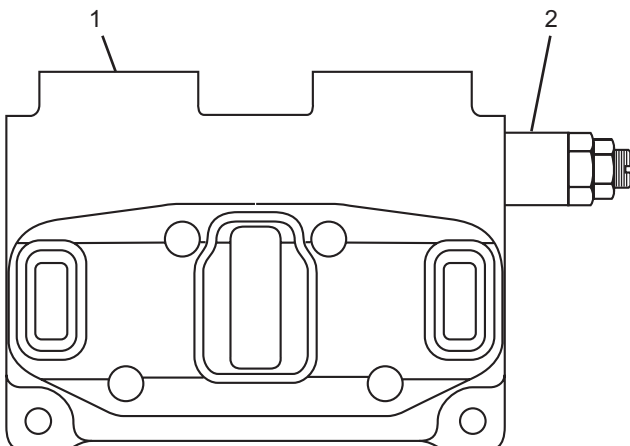


Figure 34

### 4.3.2 Lo-boy Work Section

A lo-boy work section (Figure 35, Item 1) is used if no workport relief valves or similar devices are required.

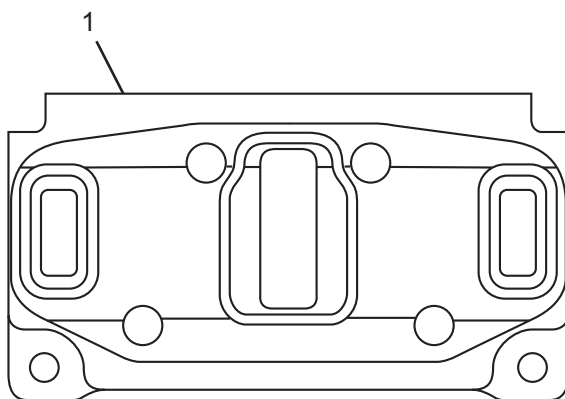


Figure 35

### 4.3.3 Spool Valve Leakage

The spool valves have a natural leakage factor. This leakage is the oil movement along the clearance between the actual spool and bore the spool rides in. The oil film has to be maintained in this clearance to allow the oil to clean, lubricate, and cool. The warmer the oil, the more leakage there will be. The higher the pressure the spool valve is experiencing, the more leakage there will be. The maximum normal leakage from a spool valve port is 30 ccs per minute at 120°F (49°C). This leakage may affect the function that the spool valve is operating and must be dealt with when necessary.

## 4.4 Work Port Relief Valve

### ⚠ WARNING

Increasing hydraulic pressure beyond the recommendations may result in serious damage to the Packer or serious personal injury may void the Packer Warranty. If you have questions concerning hydraulic pressures or testing procedures, please contact McNeilus Truck and Manufacturing, Inc. at 888-686-7278 before attempting the test procedures or making adjustments.

Work port relief valves are used to control the pressure to individual ports on the work sections. Both the VA20 and VA35 work sections use the same style work port relief valve. Individual adjustments are required for individual functions.

There are two ways a work port relief valve control pressure:

- Limits the function's pressure to less than the main relief valve setting when the spool valve is shifted.
- Protects the function from excessive pressure when the spool valve is in NEUTRAL position.

## 4.5 Outlet Sections

Two types of outlet sections are used:

### 4.5.1 Power Beyond Outlet Section

A power beyond outlet section is required on valve assemblies if another valve assembly is used downstream. If the valve assembly with a power beyond outlet is used to operate a function, the power beyond outlet section will not deliver a flow of oil to the downstream valve assembly.



*If a power beyond outlet section is not used when two valve assemblies are operated at the same time, the pressure from both of them will combine and could exceed the capability of the components and the pump. The main relief or port relief valve, whichever is lower, will open.*

### 4.5.2 Standard Outlet Section

A standard outlet section is used if there are no downstream valve assemblies or functions.

## 4.6 Adding Hydraulic Options

It is important the hydraulic system on your McNeilus refuse vehicle be correct to prevent excessive pressure drop, restricted flows, and overheating. Often flow dividers and other hydraulic devices are added to the refuse vehicle's hydraulic system which interfere with the normal operation of the refuse vehicle's hydraulics. The net result is often shortened life of the hydraulics due to pressure and heat problems and contamination. Incorrectly installed after-market hydraulics may void the refuse vehicle warranty.

If we are aware that options will be added to the refuse vehicle after it leaves the factory, we can often best accommodate the option when the refuse vehicle is being built. Many options such as cart tipplers, reeving cylinders, etc. are common and easily accommodated when we know they are being added later. Other options which we many not be familiar with may require information such as the number of functions on the option, the flow and pressure required for the option, and what the option is required to do. Once we know this information, we can design the system which is compatible with the refuse vehicle's hydraulics. Frequently, it is less expensive to set up the refuse vehicle hydraulics at the factory than it is to add them after the refuse vehicle is built.

The most common system for operating standard functions such as cart tipplers, reeving cylinders, etc. is to add an additional work section with controls during the manufacturing process. This allows the refuse vehicle's hydraulics to be compatible with the options. It also means the components such as the controls, linkage, brackets, and cylinders are primed and painted when the refuse vehicle goes through the factory paint booth.

We have several ways of allowing the refuse vehicle hydraulics to work as required by the customer without interfering with the refuse vehicle's normal functions and speed. Some options may require additional hydraulic oil capacity and individual filtering.

## 5.0 Hydraulic Cylinders

### **⚠ DANGER**

**Use extreme caution around the Packer and slide area on the rear of the Packer. Be sure the area in the hopper is clear before operating the controls. Serious personal injury or death may result if someone is caught in the Packer or slide panels.**

### **⚠ DANGER**

**Be sure all individuals are clear of the tailgate area before opening the tailgate. Remain attentive at all times. Be sure you have adequate clearance above the tailgate to prevent contact with buildings or electrical lines. Serious injury or death may result if someone is caught in the path of the tailgate.**

### **⚠ DANGER**

**If opened in the shop or for maintenance, support the tailgate to prevent the tailgate from coming down unexpectedly. Serious injury or death may result if someone is caught in the path of the tailgate.**

## 5.1 Cylinder Identification

A tag is attached to each cylinder showing that individual cylinder's serial number. This information is recorded at the factory when the refuse vehicle is manufactured. Anytime you are referring to a cylinder or ordering cylinders or seal kits, please use the identification number.

## 5.2 Cushion Cylinders

Some applications require hydraulically cushioned cylinders. The hydraulic cushioning will allow the cylinders to decelerate at a controlled rate immediately before completing their stroke.

As the cushion cylinder retracts (Figure 36, Item 1), oil at the barrel end escapes out the rear port.

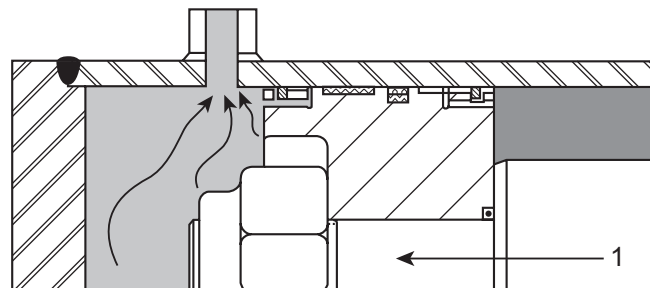


Figure 36

Note the piston ring (Figure 37, Item 1) position. The piston ring is free to move with the oil flow. Once the piston passes the rear port, the oil is forced to go through the orifices in the piston until the rod stops at the bottom of the cylinder.

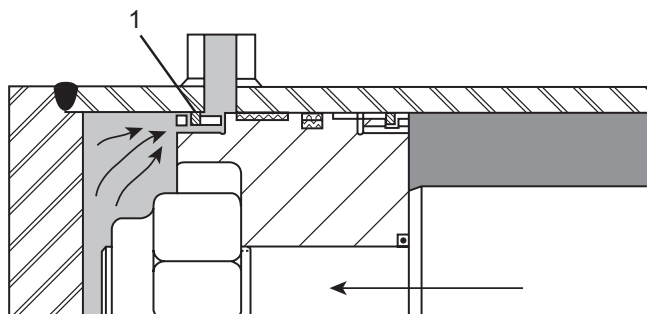


Figure 37

When oil flows into the rear port to extend the cylinder (Figure 38, Item 1), the piston ring (Figure 38, Item 2) moves to the opposite end of its groove. An additional oil path is now available for the oil to quickly flow into the cylinder. This allows the cylinder to extend at a normal speed.

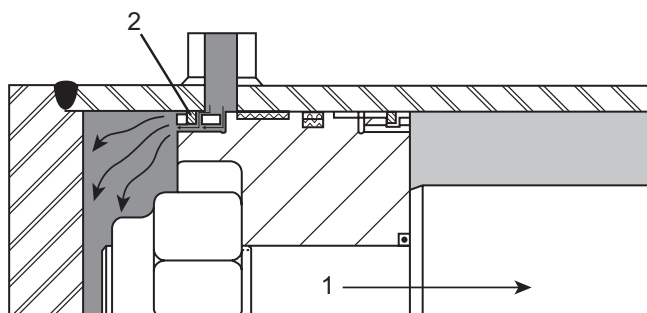


Figure 38

## 5.3 Cylinder Orifice

The tailgate and body raise cylinders have metering orifices (Figure 39, Item 1) in the barrel end ports. These metering orifices control the up and down speeds of the function. It is important the orifices remain in the tailgate and body raise cylinders. Without the orifices, the down speed of the functions can be excessive.

- The 7 in. body raise cylinder uses a 1/4 in. orifice.
- The 6 in. body raise cylinder uses a 3/16 in. orifice

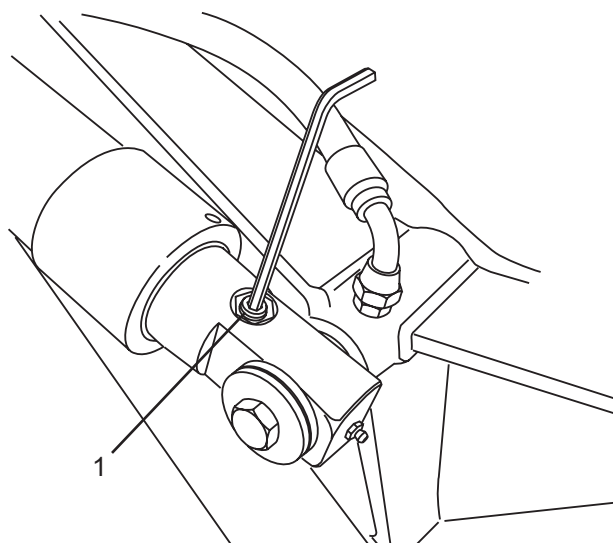


Figure 39

## WARNING

**The tailgate and body raise cylinder orifices must remain in place. Serious personal injury or death may result if the tailgate or body lowers unexpectedly.**

## 5.4 Cylinder Leakage Check

The efficiency of a cylinder can be determined by checking its internal leakage.

1. Cycle the cylinder until the cylinder is warm. Fully extend the telescopic cylinder.
2. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
3. Remove and cap the retract port hose on the cylinder.
4. Put a correct size fitting on one end of a short piece of hydraulic hose.
5. Attach this hose into the retract port on the cylinder. Be prepared to catch some oil in a container.
6. Remove your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
7. Pressurize the extend port to the maximum function pressure by activating the extend control. Hold the control in the extend mode.
8. Measure the amount of oil that flows into your container in one minute.
9. Perform your company's Lockout/Tagout procedure. If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
10. Remove all hoses and fittings.

11. Return to the original configuration.
12. Tighten all fittings.
13. Remove your company's Lockout/Tagout procedure.  
If your company does not have a Lockout/Tagout procedure, follow OSHA 1910.147 and 1910.146 Confined Space as appropriate.
14. Check for leaks.

## 5.4.1 Double Acting Cylinders

The double acting cylinder will have very little, if any, leakage (measured in drops) because it has a positive seal.

## 5.5 Purging Air from the Hydraulic System

Hydraulic systems with double acting cylinders on the McNeilus refuse vehicle are self-purging. If you work on the hydraulic system, you should operate all functions several times. This will purge air from the cylinders, spool valves, and hoses.

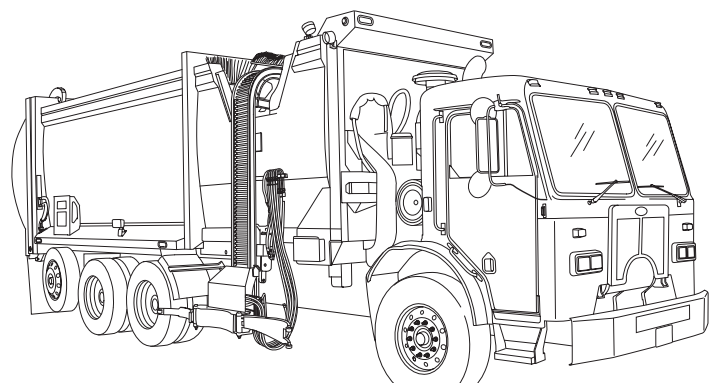
After you have purged all hydraulic systems, check the oil level in the reservoir with all cylinders retracted.

### SAFETY NOTICE

**Overfilling the reservoir may cause damage to the hydraulic system.**

On hydraulic systems with single acting cylinders, for example, the body raise cylinders, on a dump unit require purging.

To purge the hydraulic system, extend the single acting cylinder. Open the purger on the rod end of the cylinder until all air is expelled.



# Pneumatic Components

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## 1.0 Pneumatic Components

### 1.1 Air Pressure Protection Device

The factory installed 75 psi holdback valve is utilized to separate air pressure from the AutoReach body functions and the chassis air brakes. At 75 psi and below, this valve prevents air pressure from operating the AutoReach body functions in order to ensure adequate air pressure to operate the chassis service brakes.

### 1.2 Coalescing Filter

The coalescing filter removes solid contaminants as well as liquid vapors that are present in the air. MAC valve tolerances are very tight and cannot withstand dirty air. This filter should be drained on a daily basis and the element should be inspected and/or replaced every 150 hours of operation (when the element shows signs of discoloration). The element should be replaced no matter what every 1250 hours of operation. See the Preventive Maintenance section of this manual for more information.

### 1.3 Joystick Shuttle Valves

The joystick shuttle valves are present on AutoReach refuse vehicles with dual joysticks (driver and passenger). These shuttle valves have a check ball that shifts when one or the other joystick is used. This prevents feedback air from reaching the opposite joystick.

### 1.4 MAC Valve Layout

Arm Raise  
Pack Assist Down  
Pack Assist Up  
Body Down  
Body Up  
Joystick  
Curbside Joystick  
Main Air

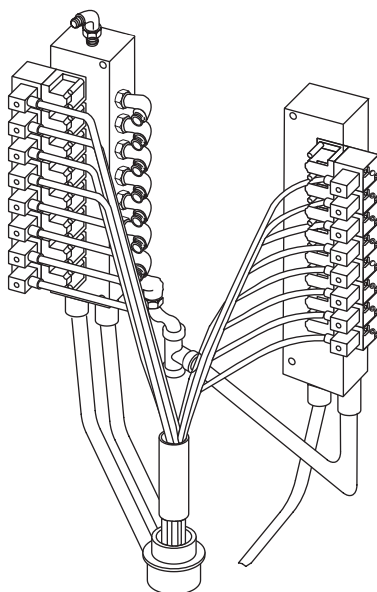


Figure 1

Arm Down  
Arm Up  
Arm Out  
Arm In  
Arm Right  
Arm Left  
Grabber Close  
Grabber Open

Tailgate Open  
Tailgate Close  
Ejector Retract  
Ejector Extend

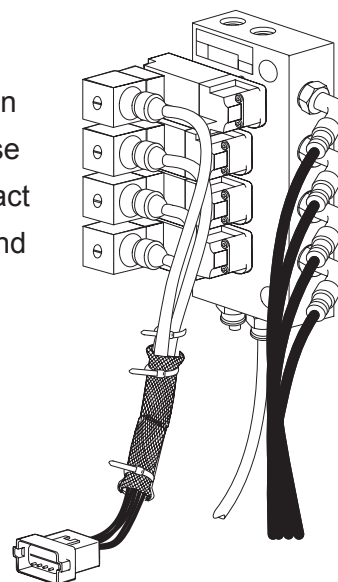
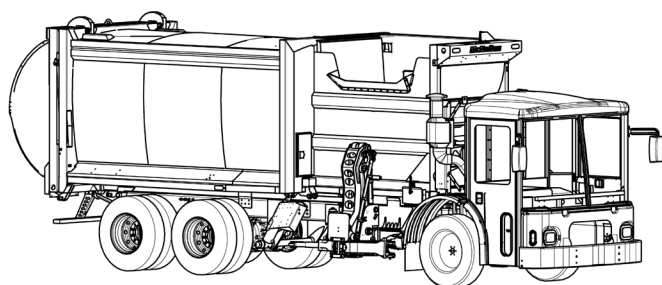


Figure 2

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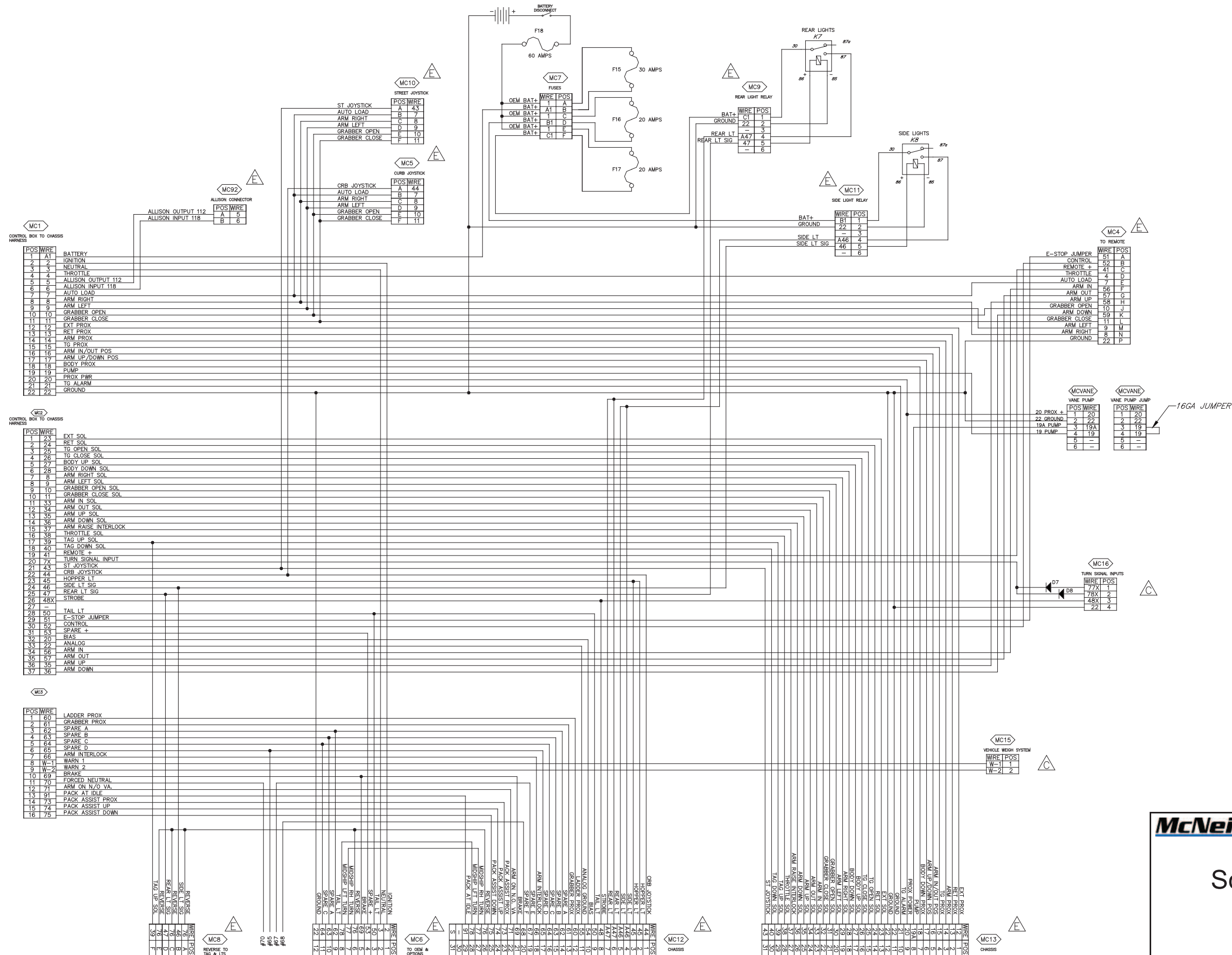
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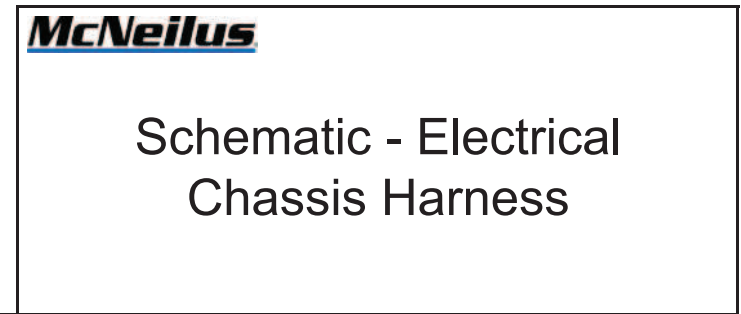
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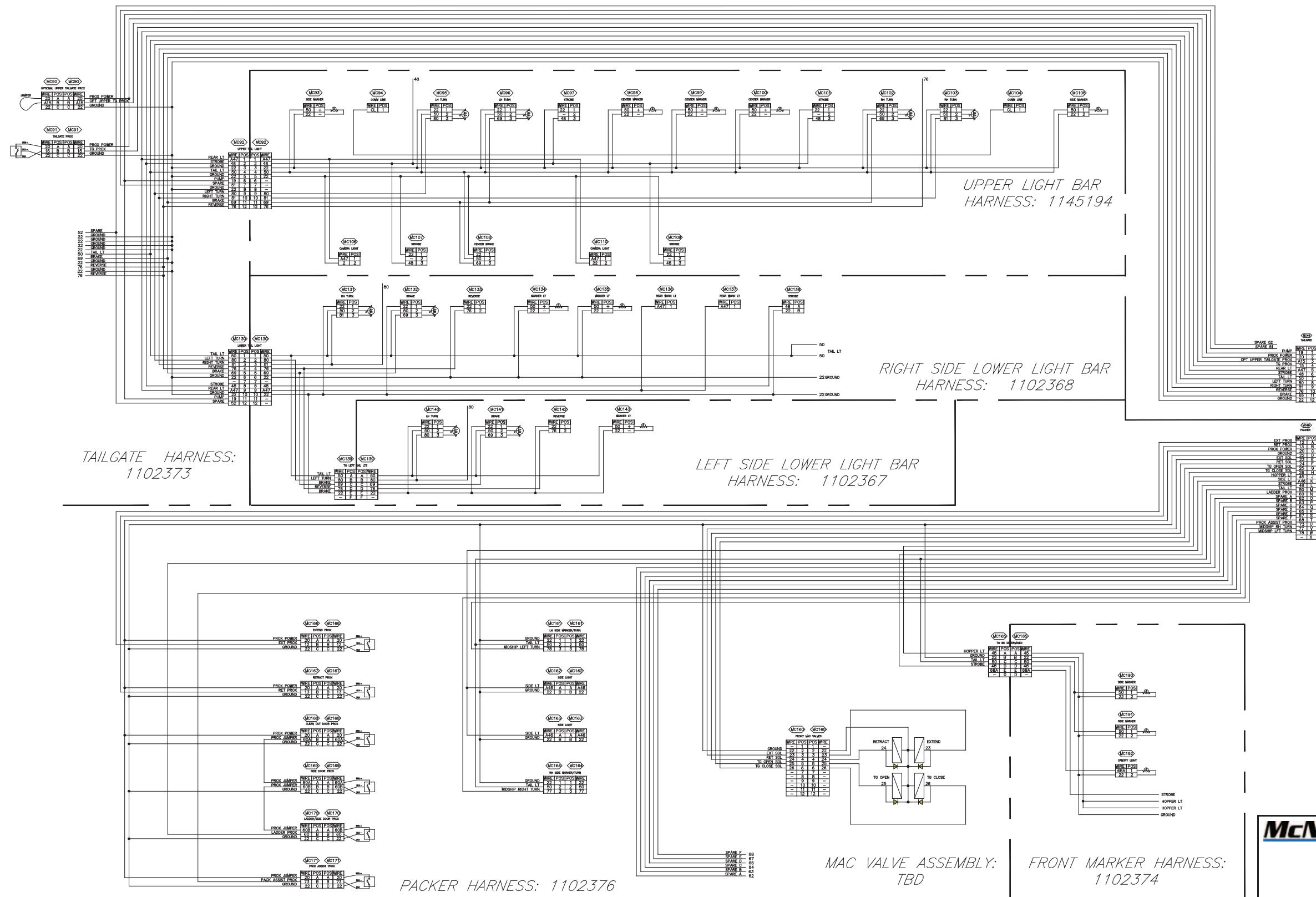
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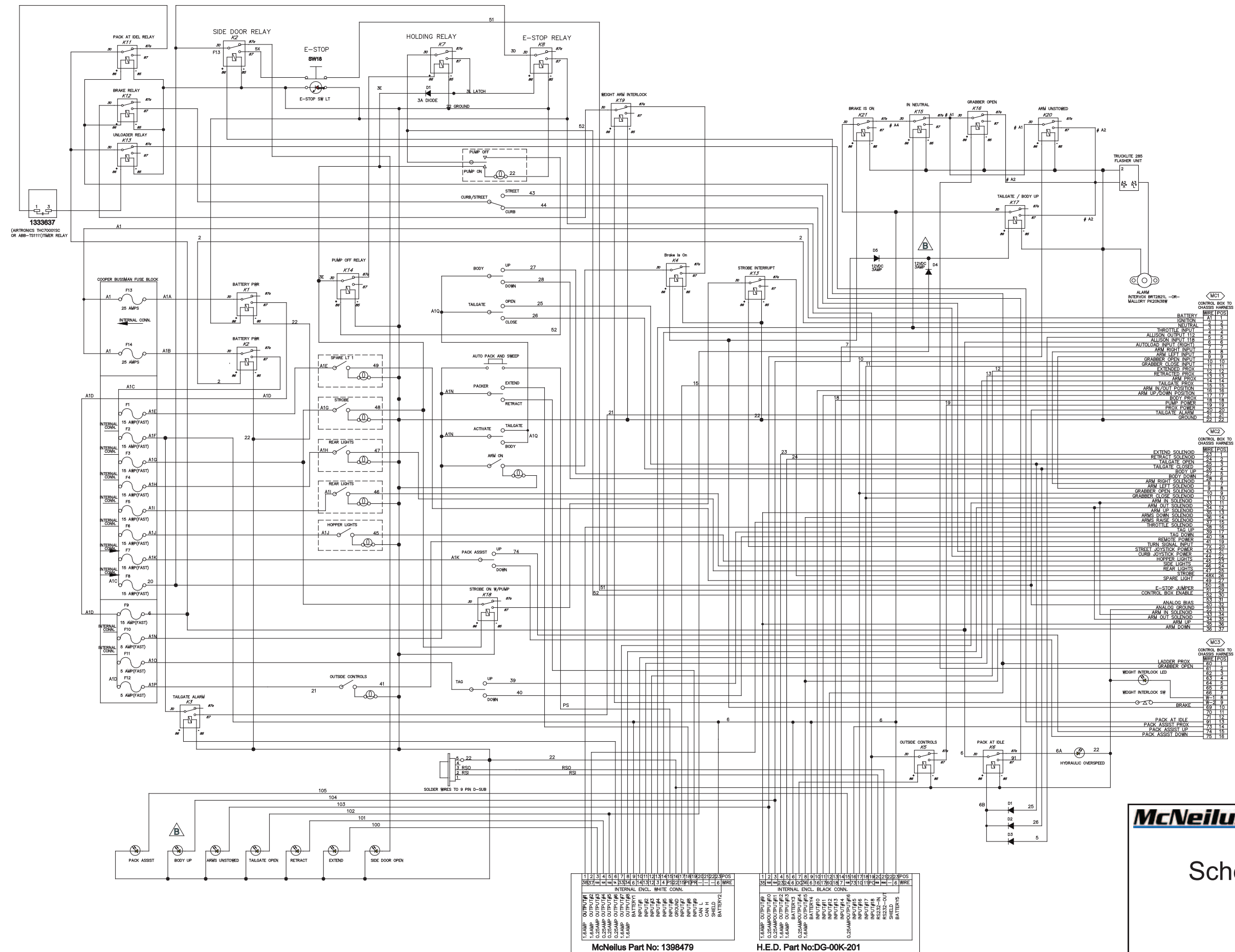
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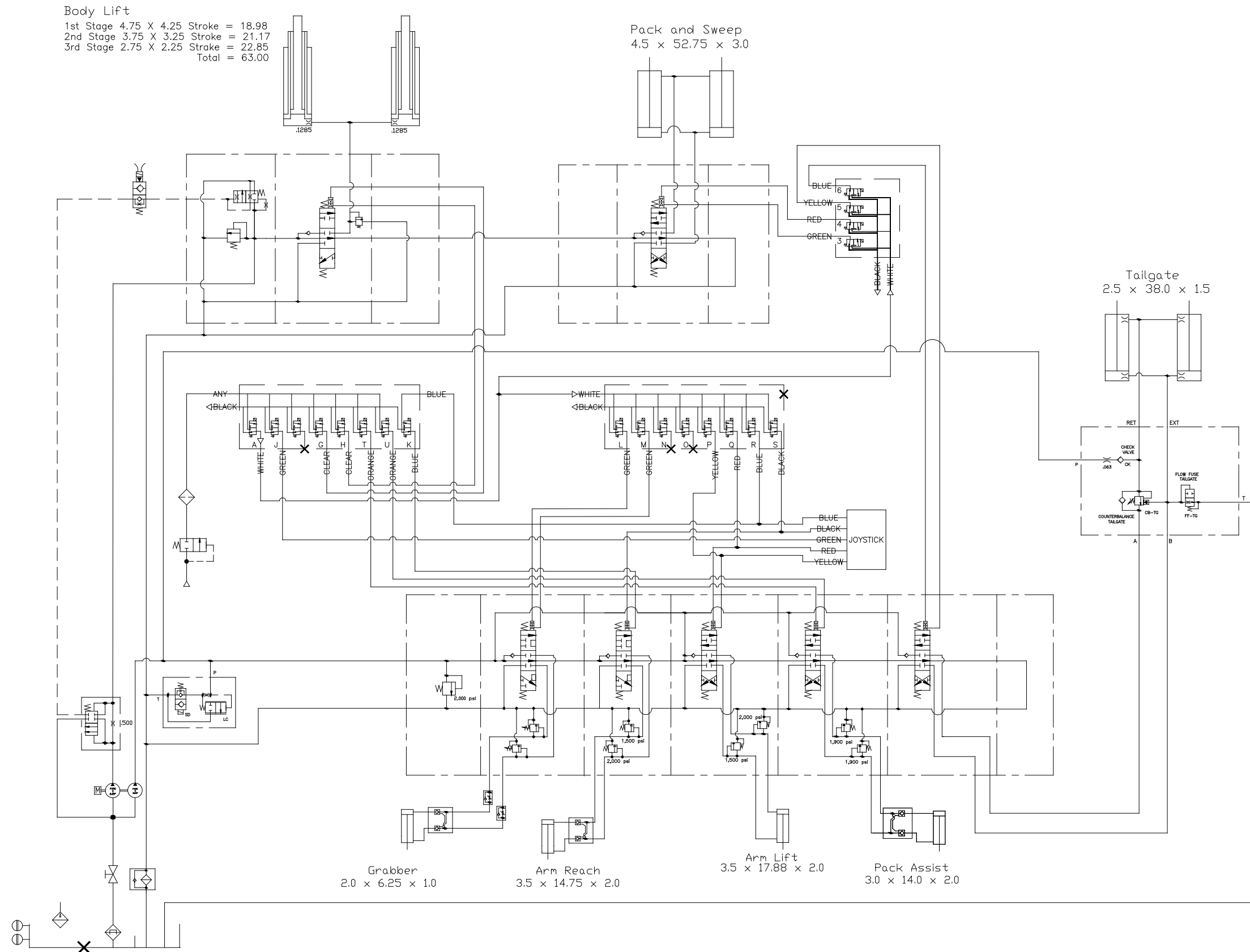












**McNeilus**  
 Schematic, Hydraulic  
 AutoReach  
 Dual Gear Pump,  
 Tailgate on VA20

